Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

Application of	)	
DIRECTV ENTERPRISES, LLC	)	File No. SAT-LOA-2004_____
For Authorization to Launch and Operate DIRECTV 8, a Direct Broadcast Satellite, at 101° W.L.	)	

APPLICATION FOR AUTHORIZATION TO LAUNCH AND OPERATE DIRECTV 8, A DIRECT BROADCAST SATELLITE

William M. Wiltshire
Michael D. Nilsson
Fred B. Campbell

HARRIS, WILTSHIRE & GRANNIS LLP
1200 Eighteenth Street, N.W.
Washington, DC 20036
202-730-1300 tel
202-730-1301 fax

TABLE OF CONTENTS

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

Application of	)	
DIRECTV ENTERPRISES, LLC	)	File No. SAT-LOA-2004_____
For Authorization to Launch and Operate DIRECTV 8, a Direct Broadcast Satellite, at 101° W.L.	)	

APPLICATION FOR AUTHORIZATION TO LAUNCH AND OPERATE DIRECTV 8, A DIRECT BROADCAST SATELLITE

DIRECTV Enterprises, LLC ("DIRECTV") hereby requests authorization to launch and operate DIRECTV 8, a satellite in the Direct Broadcast Satellite ("DBS") service. The satellite will replace the DIRECTV 2 satellite at the nominal 101° W.L. orbital location, and will be collocated with the DIRECTV 1, DIRECTV 1R, and DIRECTV 4S satellites currently operating at that slot. In a separate but interrelated application filed by DIRECTV today, DIRECTV seeks authority to modify its Ka-band satellite authorization at the same orbital slot to create a hybrid DBS/Ka-band space station.

DIRECTV currently operates a DBS system consisting of six high-power DBS satellites at the 101° W.L., 110° W.L., and 119° W.L. orbital locations.[1] DIRECTV uses these satellites to retransmit digital video and audio entertainment, educational and

[1] DIRECTV has requested a grant of Special Temporary Authority to move its DIRECTV 5 satellite, currently inactive and located at the 119° W.L. slot, to a Canadian DBS slot at 72.5° W.L. in order to provide local-into-local service to additional markets.

informational programming to more than 11 million subscribers throughout the United States who receive this programming using small dish antennas.

As set forth below, the addition of DIRECTV 8 to DIRECTV's existing constellation of DBS satellites will provide much-needed in-orbit redundancy for DIRECTV's DBS system and guard against potential interruptions in the service enjoyed by millions of Americans. The satellite will also provide improved coverage of Alaska and Hawaii. Deployment of DIRECTV 8 will enhance DIRECTV's ability to continue to offer U.S. consumers a powerful multichannel video programming distributor ("MVPD") alternative to services offered by incumbent cable operators.

Consistent with Commission rules,[2] DIRECTV intends to begin construction of DIRECTV 8, at its own risk, pending Commission action on this request in order to complete construction and launch of its satellite within the next year. Given the short timeframe, DIRECTV requests that the Commission grant this application as expeditiously as possible.

I. BACKGROUND

In December 1993, DIRECTV's affiliate and predecessor in interest, Hughes Communications Galaxy ("HCG"), launched DIRECTV 1, the United States' first DBS satellite. HCG launched DIRECTV 2 in August 1994.

In June 1995, the Commission consented to the *pro forma* assignment of the licenses and facilities necessary to operate DIRECTV's DBS system from HCG to

---

[2] 47 C.F.R. § 25.113 (f).

DIRECTV.[3] In that same month, DIRECTV launched DIRECTV 3 and collocated it at the 101° W.L. orbital location.

In August 1999, DIRECTV received authority from the Commission to launch and operate its DIRECTV 1R satellite and collocate it with DIRECTV's system of DBS satellites at the 101° W.L. slot. In April and May 1999, the Commission authorized DIRECTV to acquire licenses for three DBS channels at 110° W.L. and 11 DBS channels at 119° W.L.[4] In November 2001, DIRECTV launched the United States' first spot beam satellite, DIRECTV 4S, into the 101° W.L. orbital position to facilitate its ability to offer consumers satellite-delivered local broadcast channels.[5] And most recently, DIRECTV launched a second spot beam satellite, DIRECTV 7S, to the 119° W.L. orbital location in order to expand to over 100 the number of markets in which DIRECTV can offer consumers local-into-local services.[6]

DIRECTV recently celebrated the tenth anniversary of the launch of its DBS service. It is now time to replace DIRECTV 2, one of the first two satellites that enabled DIRECTV to launch its service a decade ago, which is due to run out of fuel in 2006. DIRECTV 8 has more capabilities than the satellite it is replacing, and will provide

---

[3] *See* Letter from Thomas Tycz to Latham & Watkins, File No. 101-SAT-AL-95 (dated June 5, 1995).

[4] *See United States Satellite Broadcasting Co., Inc.*, 14 FCC Rcd. 4585 (1999); *Tempo Satellite, Inc.*, 14 FCC Rcd. 7946 (1999).

[5] *See DIRECTV Enterprises, Inc.*, 16 FCC Rcd. 18530 (Int'l Bur. 2001).

[6] *See DIRECTV Enterprises, LLC*, 19 FCC Rcd. 7754 (Int'l Bur. 2004). In July 2003, DIRECTV also received temporary authority to (1) relocate DIRECTV 6 to the 110° W.L. orbital location to enhance its DBS service to Hawaii and to provide high-definition television programming; and (2) return DIRECTV 1 to 101° W.L. *See DIRECTV, Inc.*, 18 FCC Rcd. 13166 (Int'l Bur. 2003). Applications for permanent authority for these relocations remain pending.

DIRECTV with much-needed redundancy for operations at all three of the orbital locations from which it provides DBS service.[7]

The DIRECTV 8 hybrid Ka-band/DBS spacecraft is currently under construction by Space Systems/Loral ("Loral"). By this application, DIRECTV seeks authority to launch and operate the DBS payload of the DIRECTV 8 spacecraft.

II. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST

Authorizing DIRECTV to launch and operate the DIRECTV 8 satellite in the manner discussed herein will result in a significant upgrade in the quality and reliability of DIRECTV's DBS satellite constellation. In addition, it will allow DIRECTV to use a single hybrid satellite to efficiently provide services in two different bands.

As Congress and the Commission both have recognized, the continued success of DBS is integral to the establishment of a more competitive market for the delivery of MVPD services. In the Commission's most recent report on the status of competition in the MVPD market, the Commission reiterated that DBS "has become the most significant competitor to cable."[8] Although, as of June 2003, 75% of all MVPD subscribers received their video programming from a franchised cable operator,[9] DIRECTV is the most successful of the handful of competitive alternatives available to American consumers.

DIRECTV 8 will provide full, 50-state coverage via 16 national beam channels from 101° W.L. This capability will not only enhance DIRECTV's ability to deploy new

---

[7] In this application, DIRECTV seeks authority for operation using 16 odd-numbered DBS channels at the 101° W.L. orbital location. However, DIRECTV 8 is also capable of operating over the six highest even-numbered DBS channels, which gives DIRECTV the flexibility to operate the satellite over all of its assigned DBS channels at either the 110° W.L. or the 119° W.L. orbital location should the need arise.

[8] *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, 19 FCC Rcd. 1606, 1609 (2004).

[9] *Id.*

national programming services, but will also improve DIRECTV's ability to serve the States of Alaska and Hawaii.

DIRECTV 8 will replace an older DBS satellite, significantly reducing the average age of the operating satellites in DIRECTV's constellation. In addition, DIRECTV 8 will afford DIRECTV a range of important back-up capabilities. First, it will replace DIRECTV 2, freeing it up for potential use at any of the orbital locations from which DIRECTV provides DBS service on odd-numbered channels. Second, DIRECTV 8 carries a back-up payload capable of transmitting on six even-numbered channels, which would enable it to operate over all of the DBS channels assigned to DIRECTV at 110° W.L. and 119° W.L., if needed. This back-up capability will provide important redundancy for a service that consumers expect to receive without interruption and with the highest possible signal quality.

In addition, DIRECTV 8 will be a hybrid satellite, combining DBS and Ka-band payloads on a single space station. This makes obvious sense: DIRECTV currently has separate licenses for satellites operating in two different bands at the same orbital location, and using that slot with one hybrid satellite equipped with both payloads is plainly more efficient than building two satellites. This is particularly important at the highly congested 101° W.L. orbital location, where six satellites currently operate.[10] The Commission has historically favored the use of hybrid satellites due to their patent efficiency advantages.

> Operating a state-of-the-art hybrid satellite at a particular orbital location may be more efficient than operating two single-band satellites at that location. Construction, launch and insurance costs for one, albeit larger,

---

[10] In addition to DIRECTV 1, 1R, 2, and 4S, the AMC-4 and AMSC-1 satellites operate at the nominal 101° W.L. orbital location.

> satellite will be lower than for two satellites. Moreover, advances over the past several years have made it possible to construct hybrid satellites that have technical capabilities equivalent to single-band satellites. Thus, hybrid satellites can provide cost savings to operators and customers with no decrease in technical performance.[11]

The hybrid DIRECTV 8 satellite will enable DIRECTV to capture these efficiencies and significantly reduce the costs of operating in both authorized bands.

Consistent with Commission rules[12] and in order to meet the launch milestone applicable to its Ka-band satellite authorization, DIRECTV intends to implement these changes, at its own risk, pending Commission action on this request.

For the foregoing reasons, DIRECTV requests that the Commission grant this application as expeditiously as possible.

III. INFORMATION REQUIRED UNDER SEC. 25.114 OF THE COMMISSION'S RULES

1. Name, Address, and Telephone Number of Applicant

DIRECTV Enterprises, LLC
2230 East Imperial Highway
El Segundo, CA 90245
(310) 964-0700

2. Name, Address, and Telephone Number of Counsel

William M. Wiltshire
Harris, Wiltshire & Grannis LLP
1200 Eighteenth Street, N.W.
Washington, DC 20036
(202) 730-1300

---

[11] *Hughes Communications Galaxy, Inc.*, 5 FCC Rcd. 3423 (1990). *See also EchoStar Satellite Corp.*, 18 FCC Rcd. 15875, 15878 (Int'l Bur. 2003) ("the Commission has recognized the cost efficiencies inherent in hybrid satellites and has attempted to accommodate hybrid satellites where possible"); *Hughes Communications Galaxy, Inc.*, 7 FCC Rcd. 7119, 7120 (Com. Car. Bur. 1992) (recognizing cost and other efficiencies).

[12] 47 C.F.R. § 25.113 (f).

3. Type of Authorization Requested

DIRECTV hereby applies for authority to launch and operate a replacement DBS satellite, DIRECTV 8, and collocate it with other DIRECTV satellites at the 101° W.L. orbital location. DIRECTV 8 will replace the operations currently being provided by the DIRECTV 2 satellite at 101° W.L. Among other things, DIRECTV seeks authorization for a hybrid satellite that will provide DBS service in the Ku-band and Fixed-Satellite Service ("FSS") in the Ka-band. This application relates solely to the Ku-band DBS portion of the proposed hybrid satellite.[13]

4. General Description of Overall System Facilities, Operations and Services

DIRECTV 8 will consist of a geostationary satellite located at the nominal 101° W.L. orbital location and associated ground station equipment. DIRECTV 8 is a hybrid, high-power satellite designed to provide DBS service in the AP30/30A bands (12.2-12.7 GHz (space-to-Earth) and 17.3-17.8 GHz (Earth-to-space)) and FSS in the Ka-band (18.3-18.8 GHz and 19.7-20.2 GHz (space-to-earth), and 28.35-28.6 GHz and 29.25-30 GHz (Earth-to-space)).

The DBS service will be provided to millions of customers in the United States using small receive antennas. The on-station Telemetry, Tracking and Control (TT&C) functions will be provided in the 12.2-12.7 GHz (space-to-earth) and 17.3-17.8 GHz (Earth-to-space) bands.

---

[13] Information related to the FSS portion of the proposed hybrid satellite is being filed concurrently in an application to modify DIRECTV's Ka-band authorization at 101° W.L.

The DIRECTV 8 satellite is capable of providing 16 operating uplink and downlink Ku-band transponders in right hand circular polarization ("RHCP").[14] The DBS payload is designed to provide a national beam with coverage over all 50 states (CONUS, Alaska, and Hawaii). DIRECTV will use the DIRECTV 8 satellite to replace the DIRECTV 2 satellite at the nominal 101° W.L. orbital location and continue its retransmission of digital video and audio entertainment, educational and informational programming to over 11 million subscribers throughout the United States.

5. Operational Characteristics

5.1 Frequency and Polarization Plan

Figure 5-1 shows the frequency and polarization plan of the DBS payload on the DIRECTV 8 satellite in the 12.2-12.7 GHz (space-to-Earth) and 17.3-17.8 GHz (Earth-to-space) frequency bands, including the on-station TT&C. The TT&C frequencies for transfer orbit are also shown. At the 101° W.L. orbital location, DIRECTV 8 will operate on the odd DBS channels between 1 and 31, inclusive, both in the uplink and downlink directions. Consistent with the international plan, these channels will operate using RHCP. The emission designator for the uplink and downlink will be 24M0G7W. The allocated bandwidth for this emission is 24 MHz.

---

[14] In addition, the subsytem will include the switching necessary to enable a maximum of 6 transponders out of the 16 to operate in left hand circular polarization ("LHCP") at the 110° W.L. or 119° W.L. orbital locations, on channels licensed to DIRECTV. DIRECTV does not request authority to operate on those channels in this application.

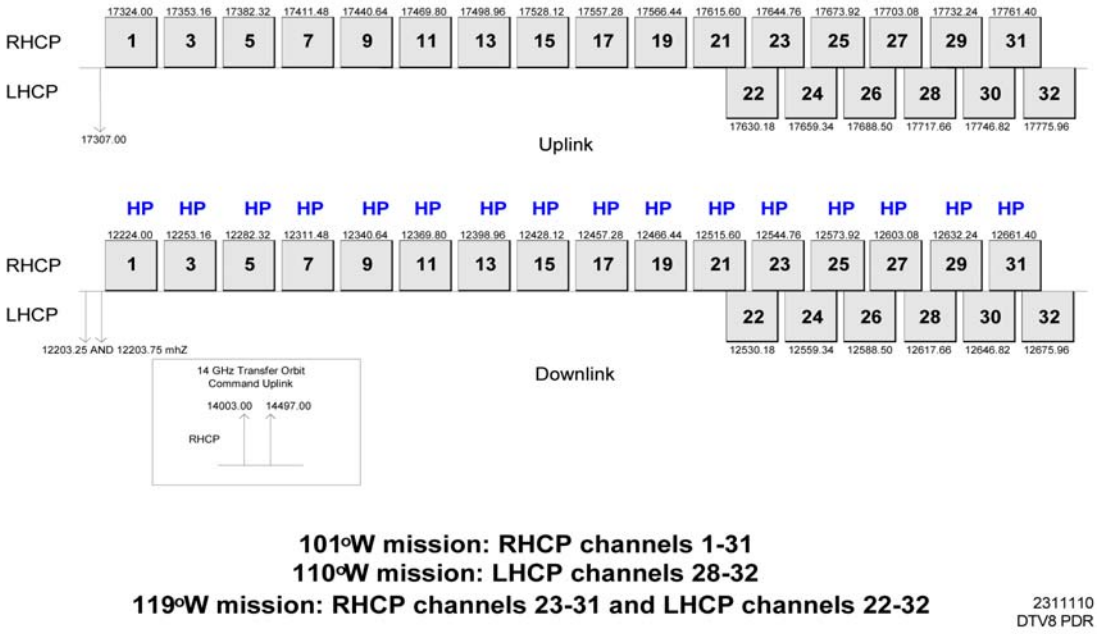


Figure 5-1. DIRECTV 8 Frequency and Polarization Plan

The interconnection capability of the DIRECTV 8 satellite is shown in Table 5-1. This table illustrates the connection of each uplink channel to its corresponding downlink channel.

Uplink Channel	Frequency (kHz)	Downlink Channel	Frequency (kHz)
1	17 324.00	1	12 224.00
3	17 353.16	3	12 253.16
5	17 382.32	5	12 282.32
7	17 411.48	7	12 311.48
9	17 440.64	9	12 340.64
11	17 469.80	11	12 369.80
13	17 498.96	13	12 398.96
15	17 528.12	15	12 428.12
17	17 557.28	17	12 457.28
19	17 586.44	19	12 486.44
21	17 615.60	21	12 515.60
23	17 644.76	23	12 544.76
25	17 673.92	25	12 573.92
27	17 703.08	27	12 603.08
29	17 732.24	29	12 632.24
31	17 761.40	31	12 661.40

Table 5-1. DIRECTV 8 Uplink/Downlink Interconnection Capability

5.2 Communications Payload

5.2.1 Uplink Transmissions

The Ku-band uplink frequency band, from 17.3-17.8 GHz, is frequency translated by the receivers with an LO frequency of 5.1 GHz to the 12.2-12.7 GHz transmit band and channelized by the input multiplexers and channel filters. It is subdivided into sixteen 24-MHz channels (*i.e.*, odd channels 1-31). In addition, the payload provides the switching to enable up to an additional six even-numbered DBS channels (22-32) while also using six odd numbered channels (23-31); however, DIRECTV does not seek authority in this application to operate in such a mode. Channelized signals are amplified by the channel amplifiers with selectable fixed/ALC modes prior to amplification in the TWTA.

Table 5-2 reflects the G/T performance for DIRECTV 8 at the Castle Rock and Los Angeles Broadcast Centers. Note that these G/T values are approximately 2 dB below the maximum G/T since both locations are away from beam peak.

Uplink	Pol.	Sys. Noise Temp, dB-K	Antenna Gain (dB)	G/T, dB/K
CRK	RHCP	30.1	30.3	0.2
LA	RHCP	30.1	30.2	0.1

Table 5-2. G/T Performance for DIRECTV 8 Uplinks

The DIRECTV 8 input multiplexer ("IMUX") employs six-pole, linear phase design filters to achieve sharp out-of-band isolation characteristics while maintaining flat in-band loss. A simulated response of the IMUXes has been calculated based on the measured performance of heritage IMUXes and the expected performance characteristics of the dielectric resonator cavities. Figures 5-2 and 5-3, respectively, show the normalized IMUX predicted rejection and insertion loss for a typical channel over the

acceptance temperature range of 75° C. The multiple responses shown simulate the response of the multiplexer at the expected cold and hot operating temperatures.

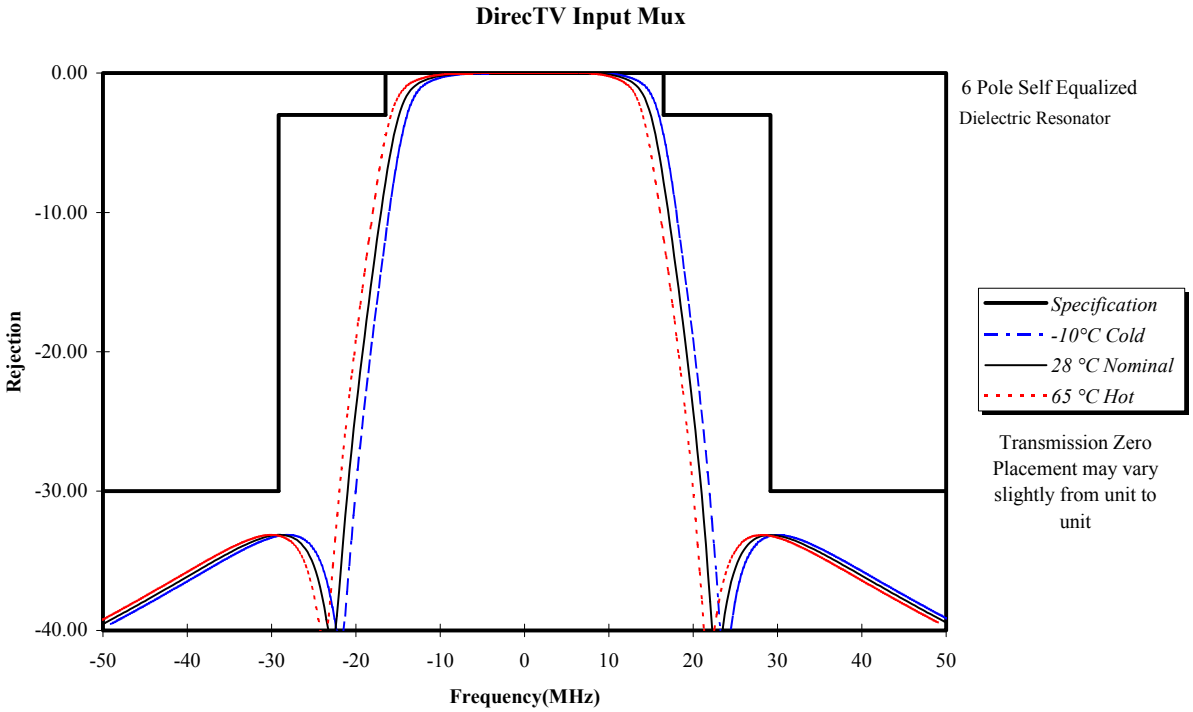


Figure 5-2. Rejection of Typical DIRECTV 8 IMUX Channel

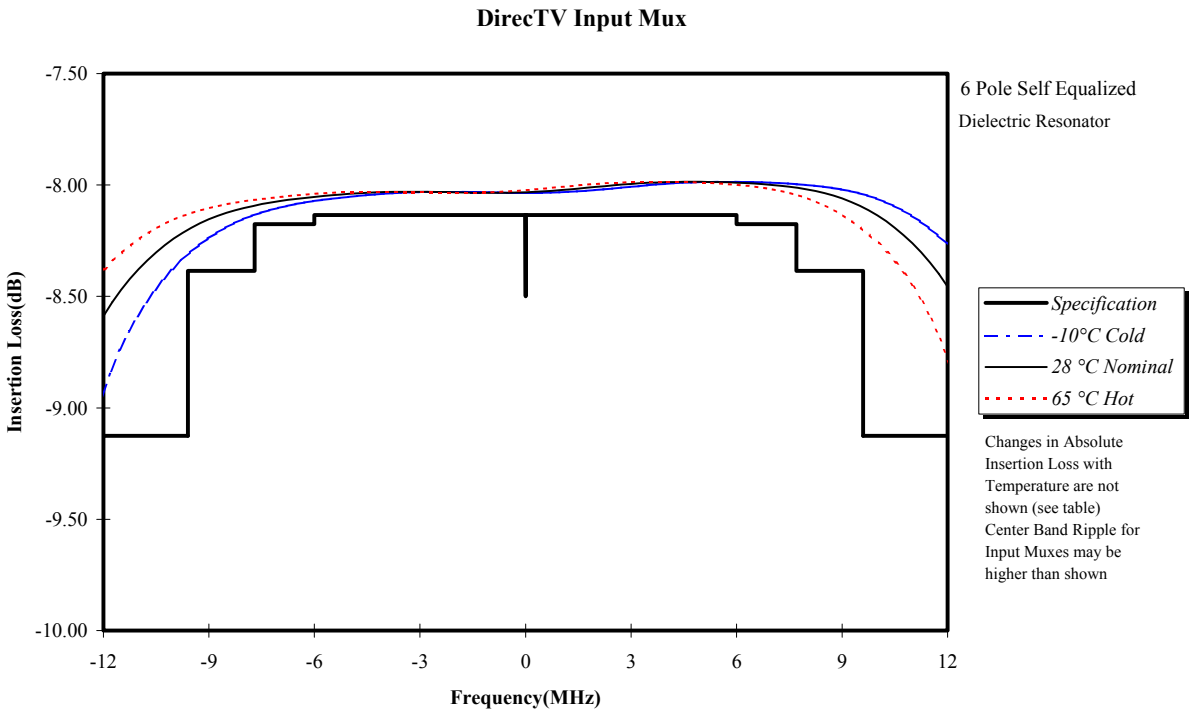


Figure 5-3. In-Band Insertion Loss of Typical DIRECTV 8 IMUX Channel

5.2.2 Downlink Transmissions

The Ku-band national coverage downlink beams use dual 113 W Direct-Radiating, Linearized, Channel-amplified TWTs ("DLCTs"). The 113 W output of the TWTA passes through a circulator on the panel near the TWTA before entering the hybrid combiner. The combiner assembly combines the output of two TWTAs to produce an output power of 226 W. The output power from the DLCT is shown in Table 5-3.

Mode of Operation	Transmit Output Power (dBW)	Output Losses (dB)	Transmit Antenna Gain (dB) Peak	Peak EIRP (dBW)
Dual Mode	23.5	1.9	35.7	57.3

Table 5-3. Transmit Power for Dual Mode DLCT Operation

The performance of the output multiplexer has been predicted by simulation, correlated with test data taken on nearly identical units from previous programs. Figures 5-4 and 5-5 show, respectively, the normalized predicted rejection and insertion loss for a typical channel filter over the protoflight temperature range. The multiple responses show the potential effect of temperature shifts and misalignment. Figures 5-6 and 5-7 show the same data for Channels 31 and 32, which have extended upper edge bands to accommodate ranging signals.

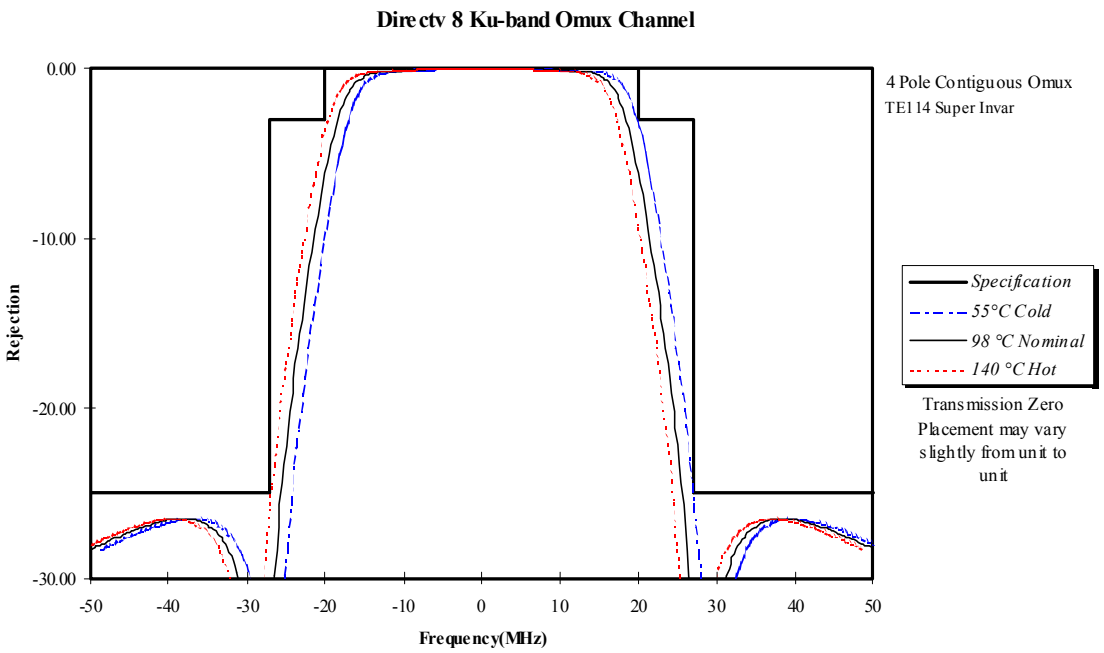


Figure 5-4. Ku-Band Output Multiplexer Predicted Rejection (Chs. 1-30)

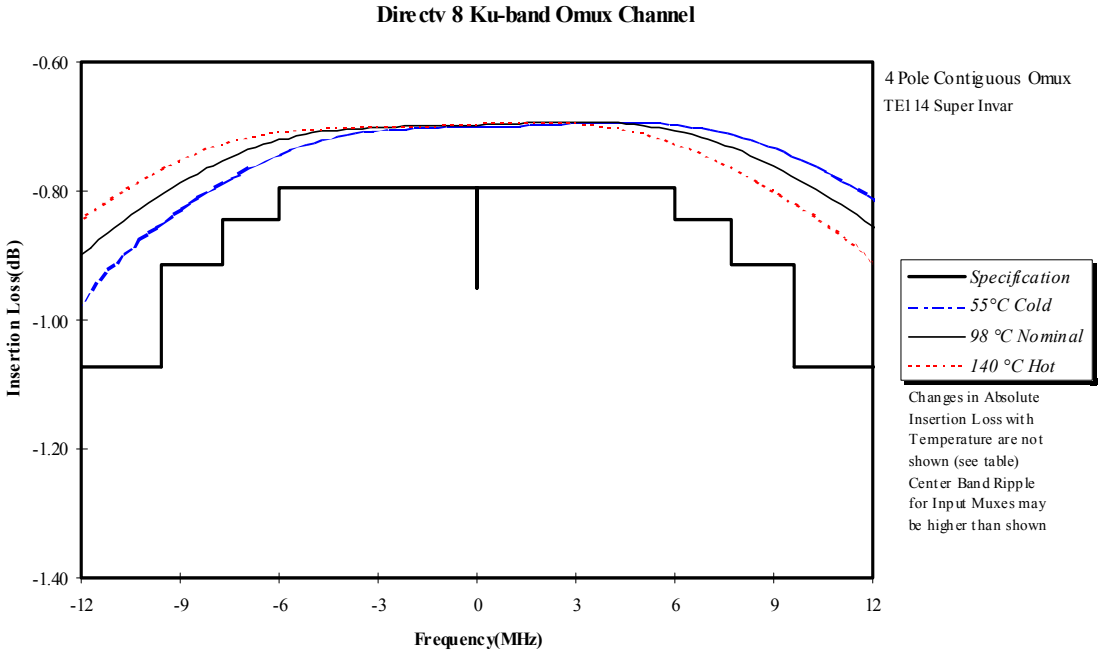


Figure 5-5. Ku-Band Output Multiplexer Predicted Insertion Loss (Chs. 1-30)

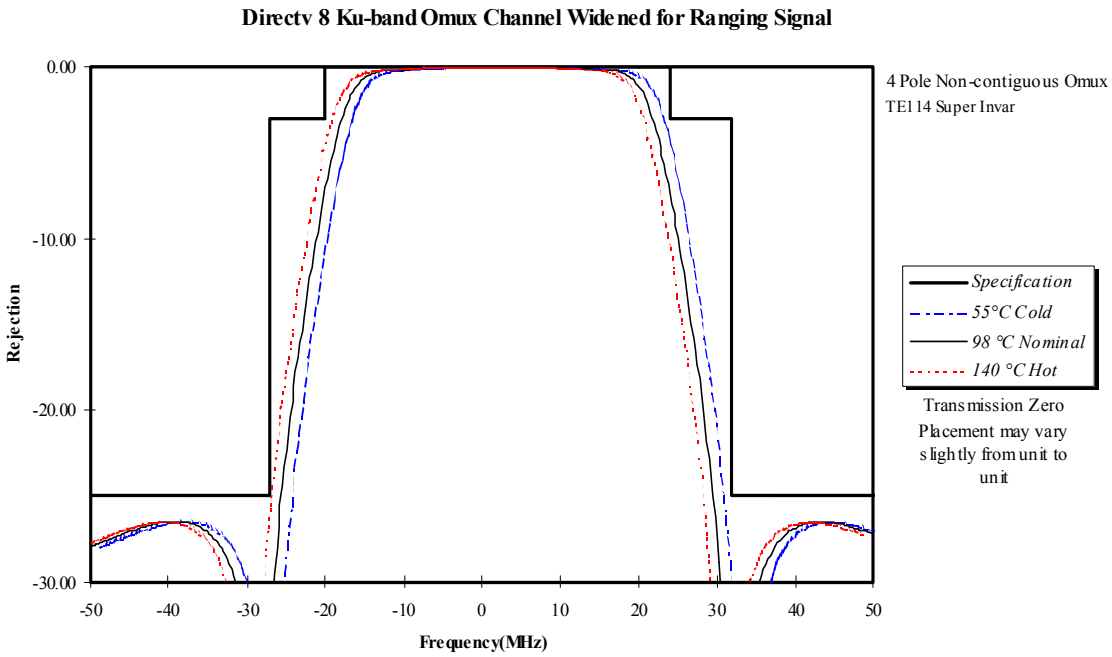


Figure 5-6. Ku-Band Output Multiplexer Predicted Rejection (Chs. 31-32)

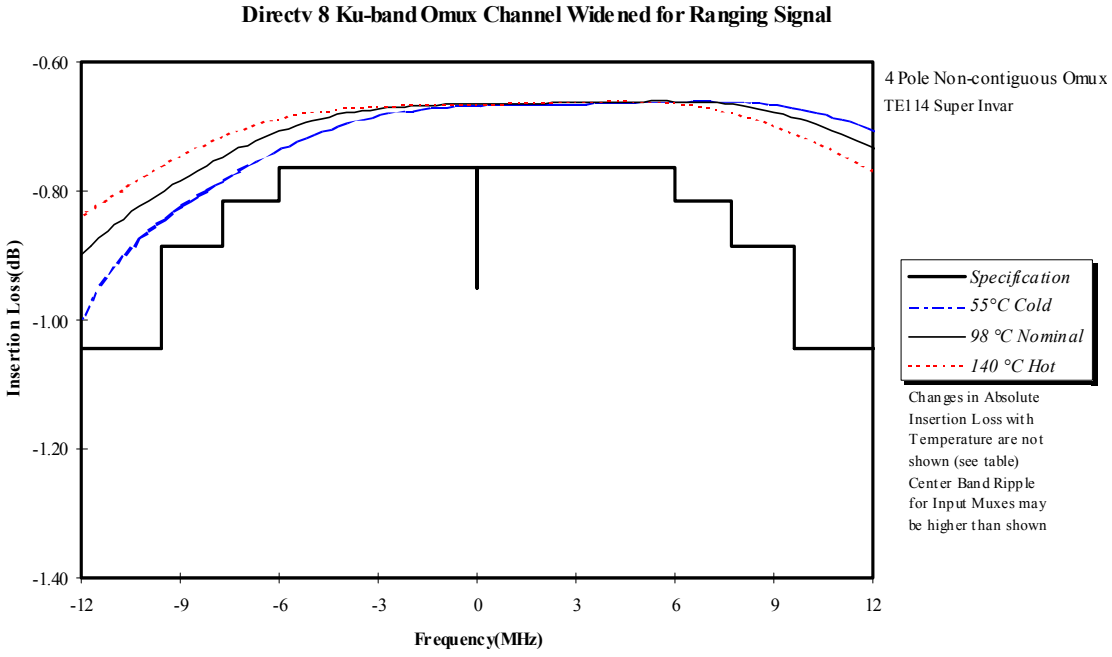


Figure 5-7. Ku-Band Output Multiplexer Predicted Insertion Loss (Chs. 31-32)

5.3 TT&C Subsystem

The TT&C subsystem provides redundant telemetry, tracking, and command channels for the spacecraft. The principal functions of the subsystem are:

1. Reception and amplification of the radio frequency command uplinks and demodulation of baseband for subsequent signal processing and command distribution
2. Modulation, up-conversion, amplification, and transmission of all telemetry data
3. Reception and retransmission of ground-station-generated ranging signals

Figure 5-8 shows a simplified block diagram of the TT&C subsystem. The subsystem is configurable to accommodate the unique requirements of pre-launch, orbit raising, and on-station synchronous orbit operations. Access at initial spacecraft acquisition and major orbit-raising maneuvers is via the wide-beam (+Z) and narrow-beam (-Z) omni antennas. During the orbit-raising mission phase, the command uplink uses the 14 GHz omni antenna.[15] The telemetry signals are routed through the 12 GHz omni antennas using the 35 W TWTAs.

Once on station, the command and telemetry systems are reconfigured to use the communications subsystem for reception and transmission via the communications antennas. The command signal goes through the Ku-band receive antenna and the telemetry signal is routed through the Ku-band transmit antenna by the appropriate setting of an R-switch.

---

[15] DIRECTV has requested a waiver of Section 25.202(g) of the Commission's rules to authorize the use of these FSS frequencies for this limited purpose.

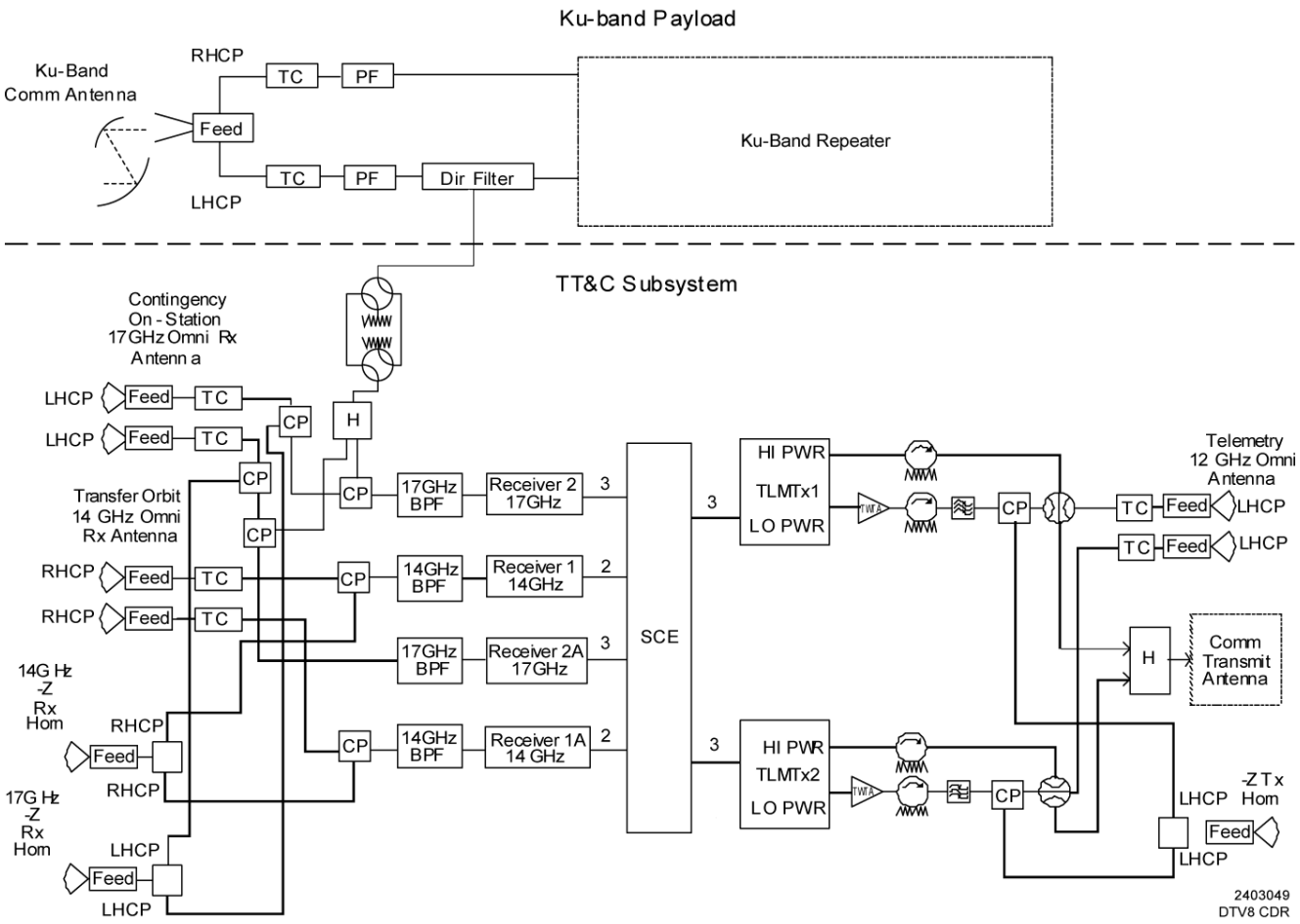


Figure 5-8. TT&C Simplified Block Diagram

The telemetry and command link performance is summarized in the link budget analysis in Appendix C. The antenna patterns for the TT&C subsystem are discussed in Section 7.3. The emission designators associated with the TT&C subsystem are 2M00F9D for command, 2M00F8D for ranging and 2M00G9D for telemetry, and the associated allocated bandwidth is 2 MHz for each of these emissions.

6. Orbital Locations

The DIRECTV 8 satellite will replace the operations currently being provided from the DIRECTV 2 satellite at the nominal 101°W.L. orbital location. DIRECTV is already authorized to operate over all 32 channels of the DBS bands (17.3-17.8 GHz (Earth-to-space)/12.2-12.7 GHz (space-to-Earth)) at this orbital location. As contemplated under Section 25.210(j)(3) of the Commission's rules, DIRECTV requests that it be authorized to operate at a slight offset from this nominal location, at 100.85° W.L. This offset is necessary due to the presence of six spacecraft – four operated by DIRECTV and two operated by other licensees – in the immediate vicinity of 101°W.L. The 0.15° offset from the nominal location requested by DIRECTV will enhance the safety of all spacecraft operating at this slot, and will also provide sufficient separation from DIRECTV 4S, which reuses some of the DIRECTV 8 uplink frequencies. The requested offset falls within the ± 0.2° offset allowance under the international plan for clusters of DBS spacecraft at a single nominal location.[16]

7. Predicted Spacecraft Antenna Gain Contours

7.1 Uplink Beams

The satellite will receive communications signals from the DIRECTV broadcast centers in Castle Rock, CO and Los Angeles, CA across the frequency band 17.3-17.8 GHz using RHCP. The receive antenna gain contour is shown in Appendix B as Figure B-1.

7.2 Downlink Beams

The national coverage antennas for Ku-band DBS service will cover CONUS, Hawaii and Alaska across the frequency band 12.2-12.7 GHz using RHCP. The transmit antenna gain contour is shown in Appendix B as Figure B-2.

7.3 TT&C Beams

The TT&C coverage is provided by the Ku-band payload transmit and receive antennas during the normal operations on station. The coverage during transfer orbit and on-station contingency is provided by simple antennas, which are oriented around the nominal +Z direction and the nominal –Z direction. The +Z coverage TT&C antenna uses a wide-flared horn on an open-ended waveguide to provide the wide-angle radiation patterns. Separate radiators are used for the 12-, 14-, and 17-GHz frequencies to satisfy the redundancy requirements. A Meanderline polarizer is placed in front of the waveguide radiators to convert the linearly polarized signals into circular polarization. The –Z coverage is provided by open-ended waveguide horns excited by TNC coax inputs. The horns use septum polarizers to produce circular polarization. The –Z coverage is provided by two telemetry horns and four command horns at 14 GHz and 17 GHz. The wide beam TT&C antenna RF performance is summarized in Table 7-1 and the coverage patterns for these antennas are shown in Appendix B as Figure B-3.

---

[16] *See* ITU Radio Regulations, Appendix 30, Annex 7, Section B.

Table 7-1. Wide Beam TT&C Antenna Performance Summary

Antenna	Frequency (GHz)	Polarization	Minimum Antenna Gain (dB)	Required Coverage (deg)
+Z Wide-angle Ant.	14.0030	RHCP	-4.0	Az ±110 and El ±50
+Z Wide-angle Ant.	14.4970	RHCP	-4.0	Az ±110 and El ±50
–Z Wide-angle Ant.	14.0030	RHCP	2.0	Az ±50 and El ±50
–Z Wide-angle Ant.	14.4970	RHCP	2.0	Az ±50 and El ±50
–Z Wide-angle Ant.	17.3070	LHCP	-2.0	Az ±45 and El ±45
–Z Wide-angle Ant.	17.3070	LHCP	-2.0	Az ±45 and El ±45
+Z Wide-angle Ant.	17.3070	LHCP	-4.0	Az ±110 and El ± 45
+Z Wide-angle Ant.	17.3070	LHCP	-4.0	Az ±110 and El ± 45
Telemetry				
+Z Wide-angle Ant.	12.20325	LHCP	-4.0	Az ±110 and El ±50
+Z Wide-angle Ant.	12.20375	LHCP	-4.0	Az ±110 and El ±50
–Z Wide-angle Ant.	12.20325	LHCP	2.0	Az ±50 and El ±50
–Z Wide-angle Ant.	12.20375	LHCP	2.0	Az ±50 and El ±50

Once the satellite is on station, the telemetry and command signals are routed through the communications subsystem for reception and transmission via the Ku-band communications antennas. The uplink pattern for command is shown in Appendix B as Figure B-1, and the downlink antenna beam pattern for telemetry is shown in Appendix B as Figure B-2.

8. Service Description, Link Description and Performance Analysis, Earth Station Parameters

8.1 Service Description

DIRECTV will use the DIRECTV 8 satellite to retransmit digital video and audio entertainment, educational and informational programming, as a replacement for the DIRECTV 2 satellite that is currently in operation at 101° W.L. With the DIRECTV 8 spacecraft and DIRECTV's other existing DBS satellites, located at the 101° W.L., 110° W.L., and 119° W.L. orbital locations, these services are provided to over 11 million customers throughout the United States who receive this programming using small dish antennas.

8.2 Link Performance

Two representative link budgets are shown in Appendix A as Figures A-1 and A-2. Note that these budgets assume a receive antenna of 45 cm and also include an entry for adjacent satellite interference (ASI) from neighboring DBS satellites nominally spaced 9^{o} away.

8.3 Earth Station Parameters

There are essentially two types of earth station used in the DIRECTV 8 DBS network – feeder-link earth stations and subscriber terminals. The feeder-link stations are relatively large transmit antennas, typically 9 to 13 meters, that track the satellite electronically and are used for transmitting programming material from the DIRECTV broadcast centers to the satellite. The subscriber terminals are effectively 45 cm receive antennas that are installed at the customers' premises and have fixed pointing, which is optimized at installation.

9. Satellite Orbit Characteristics

The DIRECTV 8 satellite will be maintained in synchronous orbit at its nominal orbital location with a North-to-South drift tolerance of ± 0.05^{o} and with an East-to-West drift tolerance of ± 0.05^{o}. The antenna axis attitude will be maintained within ± 0.119° during normal mode and ± 0.199° during orbit maneuvers (*i.e.,* station-keeping). The time weighted pointing error for Ku-band and Ka-band antennas are less than ± 0.14.

10. Power Flux Density

There are no power flux density limits in the DBS bands.

11. Arrangement for tracking, telemetry, and control

DIRECTV 8's TT&C operations will be performed by Space Systems Loral, Long Term Operations. The control center is located in El Dorado Hills, CA. The primary TT&C uplink will come from DIRECTV's Castle Rock Broadcast Center, in Castle Rock, CO. The backup TT&C uplink will come from DIRECTV's Los Angeles Broadcast Center, in Los Angeles. CA.

12. Physical Characteristics of the Space Station

Table 12-1 summarizes the key spacecraft characteristics.

Table 12-1. Summary of DIRECTV 8 Characteristics

DIRECTV 8	
Spacecraft:	Loral 1300, three axis stabilized
Launch:	
Vehicle	Proton
Site	Baikonur, Kazakhstan
Orbital slot:	100.85 degrees West longitude
Contract life:	12 years

PAYLOAD	
Hybrid Ku/Ka-band	12.2-12.7 GHz, 18.3-18.8 GHz and 19.7-20.2 GHz (space-to-Earth), 17.3-17.8 GHz, 28.35-28.6 GHz, 29.25-30.0 GHz (Earth-to-space)

POWER	
Solar Array:	Two solar wings. Each wing with four panels
Array Power Available	8399W (worst case EOL @ equinox)
Payload Load	5763W (worst case EOL @ equinox)
Bus Load	1874W including battery charge power(worst case EOL @ equinox)
Total Load	7637W (worst case EOL @ equinox)
Batteries: **Depth of Discharge (%)**	71.8%

DIMENSIONS	
In-orbit	31.3 m long, solar arrays: 8.7 m wide, antennas/radiators: 6.2 m tall, antenna
Stowed	H: 227.7mm W: 127.2mm
Mass	
At Launch	3707.9Kg
In-orbit (beginning of life)	2060.4Kg
End of life	1501.9Kg

ANTENNAS
Receive – 2.4 meter deployable, shaped main reflector and subreflector on East Transmit – 2.4 meter deployable, shaped main reflector and subreflector on East and West

13. Spacecraft Bus Subsystem

The spacecraft, part of Loral's 1300 bus series, encompasses the following design elements.

1. A rectangular mainbody that houses internal electronic equipment and externally supports communication antennas on the earth-facing side (Ka-band receive/transmit antenna), east side (Ku-band receive and transmit antenna), and west side (Ku-band transmit antenna) of the spacecraft.
2. A four-panel and a yoke mini panel-per-wing deployable solar array. The four panels are populated with Advanced High Efficiency Silicon (AHES) solar cells. The mini-panel is populated with High Efficiency Silicon

(HES) solar cells. For eclipse operation, power is stored in two 34-cell, 149-Ah nickel-hydrogen (NiH_2) batteries.

3. Stabilization on orbit and antenna pointing are accomplished using a momentum-biased Attitude Determination and Control System (ADCS). This system measures satellite attitude, relative to the Earth, via scanning infrared Earth sensors; processes the error information; and controls the spacecraft by operation of the momentum wheels. For normal operation, two momentum wheels operate in a 'V' mode. In the unlikely event of a momentum wheel failure, a reaction wheel provides redundancy and operation in the 'L' mode. These elements provide for the required pointing stability.

4. The design of the bi-propellant propulsion subsystem has a strong, successful heritage history. Propellants for the integrated bipropellant propulsion system are stored in two large cylindrical tanks that are supported within the spacecraft central cylinder. Pressure to the system is provided by two cylindrical helium-filled pressurant tanks located on the east and west sides of the mainbody just above the ADCS deck. The 12 attitude control thrusters are mounted on the corners and north and south sides of the mainbody on the Earth and anti-Earth decks. The main satellite thruster is located in the lower central cylinder along the mainbody thrust-axis, pointing in the anti-Earth direction. The bipropellant reaction control system incorporates integral latch valves and thruster valves for maximum reliability.

5. The Orbital Maneuver Lifetime (OML) of 12 years is achieved on Proton M/Breeze M, Sea Launch, Ariane V, Atlas V, and H-IIA launch vehicles.

Figure 13-1 shows the on-orbit configuration.

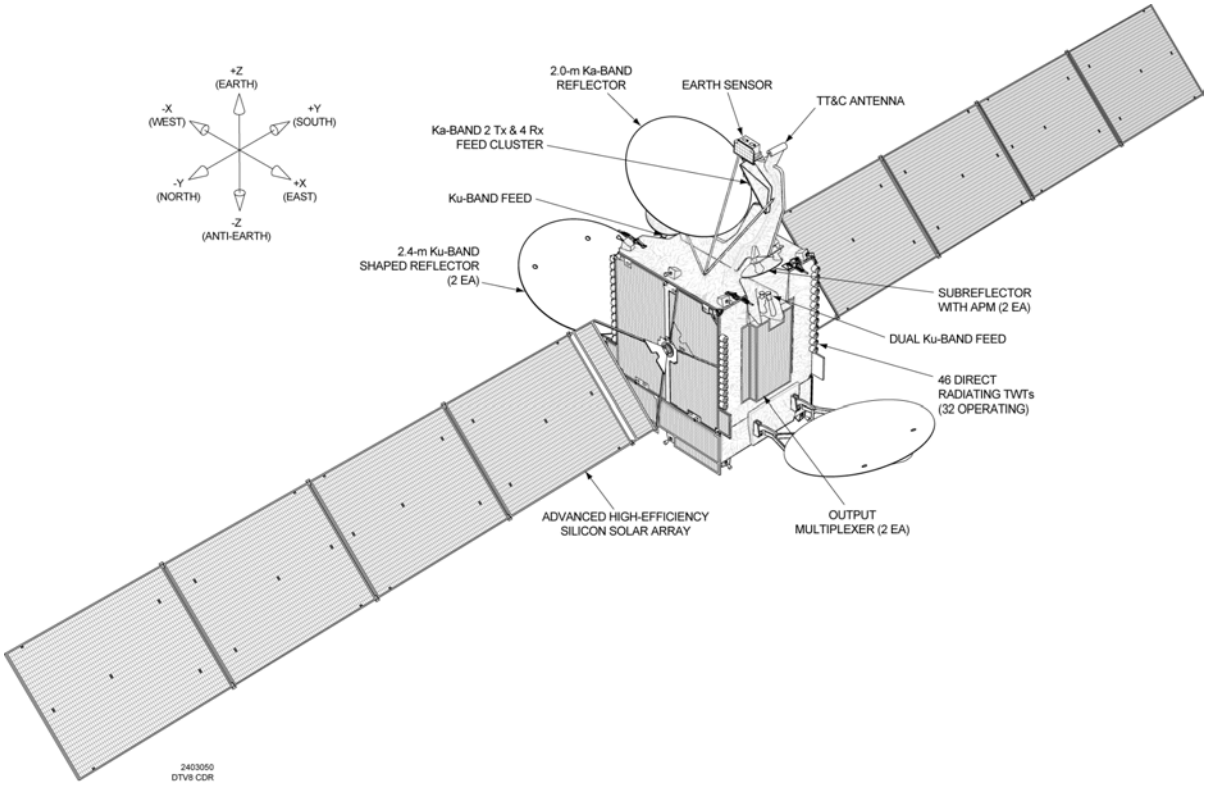


Figure 13-1. On-Orbit Configuration of DIRECTV 8

14. Common Carrier Status

DIRECTV intends to operate DIRECTV 8 on a non-broadcast, non-common carrier basis, as it operates its current satellite capacity at 101° W.L., 110° W.L. and 119° W.L. DIRECTV may sell and/or lease a portion of its capacity on a non-common carrier basis for complementary business purposes.

15. Schedule

DIRECTV 8 is currently under construction at Loral. DIRECTV anticipates that it will complete construction and launch the satellite in the spring of 2005.

16. Public interest Considerations

See Section II above.

17. Interference Analysis

Information on the characteristics of the DIRECTV 8 network required by Appendix 4 of the ITU Radio Regulations is provided in electronic format via e-mail. The Appendix 4 information is contained in a database, filename USABSS19_AP4.mdb, and 8 attachments thereto.[17] These files contain the information required by the ITU for modifications to the Region 2 Plan.

Annex 1 of this application contains interference analyses with respect to the limits in Annex 1 to Appendices 30 and 30A of the ITU's Radio Regulations. This annex provides sufficient technical detail to show that DIRECTV 8 will operate satisfactorily if all assignments in the international Broadcast Satellite Service and feeder link plans were implemented.

18. Orbital Debris Mitigation

On June 21, 2004, the Commission adopted an order establishing new orbital debris mitigation requirements for satellite applications.[18] Those rules have not yet gone into effect,[19] and DIRECTV is not now in a position to provide all of the information required under the new regime. However, DIRECTV can state as follows.

To control orbital debris, DIRECTV will use a design for its satellite and launch vehicle that minimizes the amount of debris released during normal operations. To ensure that its satellite does not become a source of orbital debris, DIRECTV will conduct an analysis to ensure that the probability of collision with any known space-

---

[17] The filenames of the attachments are as follows: (1) D8RX_CO.GXT; (2) D8RX_X.GXT; (3) D8 G-GSO.GXT (GAIN TO GSO ARC); (4) D8RX_SA.DOC (SERVICE AREA FOR UPLINK BEAM); (5) D8TW_CO.GXT; (6) D8TW_X.GXT; (7) D8SA_45.DOC (SERVICE AREA TX BEAM 45 CM); and (8) D8SA_90.DOC (SERVICE AREA TX BEAM 90 CM).

[18] *See Mitigation of Orbital Debris*, FCC 04-130 (rel. June 21, 2004).

borne objects during its normal operation lifetime is minimal. DIRECTV will also conduct an analysis that demonstrates that no realistic failure modes exist or can lead to an accidental explosion during normal operations or before completion of post-operations disposal. At the end of the operational life of the satellite, DIRECTV will maneuver its spacecraft to a storage orbit with a perigee altitude above its normal operational orbit. DIRECTV will use a maneuver strategy that reduces the risk of leaving any of its spacecraft near an operational orbit. After the spacecraft reaches its final disposal orbit, all on-board sources of stored energy will be depleted or safely secured.

DIRECTV will supplement this information as necessary to comply with the Commission's new orbital debris disclosure rules after they become effective.

VI. CONCLUSION

In summary, the proposed modifications will provide DIRECTV with a highly capable replacement DBS satellite that will ensure the continuation of high quality multichannel video service to millions of Americans.

For these reasons, DIRECTV submits that the proposed minor modification request is in the public interest and respectfully requests that the Commission expeditiously grant this request.

Respectfully submitted,

DIRECTV ENTERPRISES, LLC

By: \s_____
Romulo Pontual
Executive Vice President

---

[19] *See* 47 C.F.R. § 1.427 (rules may be made effective no earlier than 30 days after publication in the Federal Register, absent an explicit finding of good cause for earlier effective date).

ENGINEERING CERTIFICATION

The undersigned hereby certifies to the Federal Communications Commission as follows:

(i) He is the technically qualified person responsible for the engineering information contained in the foregoing Application for Minor Modification,

(ii) He is familiar with Part 25 of the Commission's Rules, and

(iii) He has either prepared or reviewed the engineering information contained in the foregoing Application for Minor Modification, and it is complete and accurate to the best of his knowledge and belief.

Signed:

/s/
David Pattillo

June 30, 2004
Date

APPENDIX A

DIRECTV 8 Link Budget Analysis

Table A-1. DIRECTV 8 Link Budget – Downlink to Chicago

DIRECTV 8 BSS, 101W		**Clear Sky**	**Rain Dn**	**Notes**
Rec. T =	125.0			
Uplink C/N (thermal), dB	Transmit power, dBW	14.7	19.7	
Castle Rock	Transmit losses, dB	-2.0	-2.0	
	Ground antenna gain, dB	65.3	65.3	
	Antenna pointing loss, dB	-0.5	-0.5	
	Free space loss, dB	-208.8	-208.8	
	Atmospheric loss, dB	-0.2	-0.2	
	Uplink rain loss, dB	0.0	-5.0	
	Satellite G/T, dB/K	0.2	0.2	
	Bandwidth, dB-Hz	-73.0	-73.0	
	Boltzmann's constant, dBW/Hz K	228.6	228.6	
Total Uplink C/N		**24.3**	**24.3**	
Downlink C/N (thermal),dB	Satellite EIRP, dBW	53.3	53.3	
Chicago	Free space loss, dB	-205.9	-205.9	
	Atmospheric loss, dB	-0.2	-0.2	
	Downlink rain loss, dB	0.0	-3.6	99.95% Avail.
	Rain temp increase, dB	0.0	-3.4	
	Rcv. antenna pointing loss, dB	-0.5	-0.5	
	Ground G/T, dB/K	13.0	13.0	45 cm
	Bandwidth, dB-Hz	-73.0	-73.0	
	Boltzmann's constant, dBW/Hz K	228.6	228.6	
Total Downlink C/N		**15.3**	**8.2**	
		Clear Sky	**Rain Dn**	
Totals	Uplink C/N (thermal), dB	24.3	24.3	
	Downlink C/N (thermal), dB	15.3	8.2	
	x-pol interference, dB	22.9	22.9	
	Aggregate C/I from ASI	25.6	25.6	
	Total C/(N+I), dB	**13.8**	**7.9**	
	Required C/(N+I), dB	**7.6**	**7.6**	QPSK
	Margin, dB	**6.2**	**0.3**	

Table A-2. DIRECTV 8 Link Budget – Downlink to New York

DIRECTV 8 BSS, 101W		Clear Sky	Rain Dn	Notes
Rec. T =	125.0			
Uplink C/N (thermal), dB	Transmit power, dBW	14.7	19.7	
Castle Rock	Transmit losses, dB	-2.0	-2.0	
	Ground antenna gain, dB	65.3	65.3	
	Antenna pointing loss, dB	-0.5	-0.5	
	Free space loss, dB	-208.8	-208.8	
	Atmospheric loss, dB	-0.2	-0.2	
	Uplink rain loss, dB	0.0	-5.0	
	Satellite G/T, dB/K	0.2	0.2	
	Bandwidth, dB-Hz	-73.0	-73.0	
	Boltzmann's constant, dBW/Hz K	228.6	228.6	
Total Uplink C/N		**24.3**	**24.3**	
Downlink C/N (thermal),dB	Satellite EIRP, dBW	55.3	55.3	
New York	Free space loss, dB	-206.0	-206.0	
	Atmospheric loss, dB	-0.2	-0.2	
	Downlink rain loss, dB	0.0	-3.9	99.95% Avail.
	Rain temp increase, dB	0.0	-3.5	
	Rcv. antenna pointing loss, dB	-0.5	-0.5	
	Ground G/T, dB/K	13.0	13.0	45 cm
	Bandwidth, dB-Hz	-73.0	-73.0	
	Boltzmann's constant, dBW/Hz K	228.6	228.6	
Total Downlink C/N		**17.2**	**9.8**	
		Clear Sky	**Rain Dn**	
Totals	Uplink C/N (thermal), dB	24.3	24.3	
	Downlink C/N (thermal), dB	17.2	9.8	
	x-pol interference, dB	22.9	22.9	
	Aggregate C/I from ASI	26.4	26.4	
	Total C/(N+I), dB	**15.2**	**9.3**	
	Required C/(N+I), dB	**7.6**	**7.6**	QPSK
	Margin, dB	**7.6**	**1.7**	

APPENDIX B

Antenna Beam Contours

Figure B-1. DIRECTV 8 Receive and On-Station Command Beam

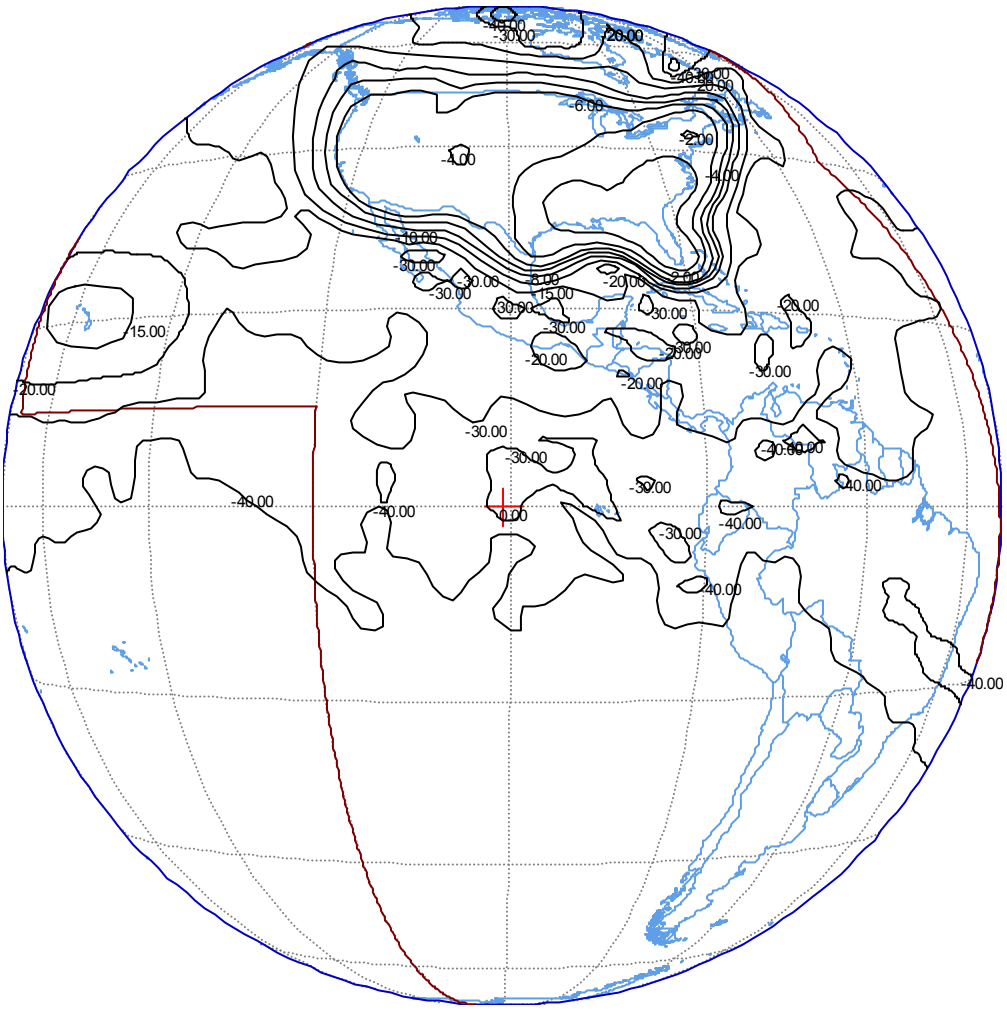


Figure B-2. DIRECTV 8 Transmit and On-station Telemetry Beam

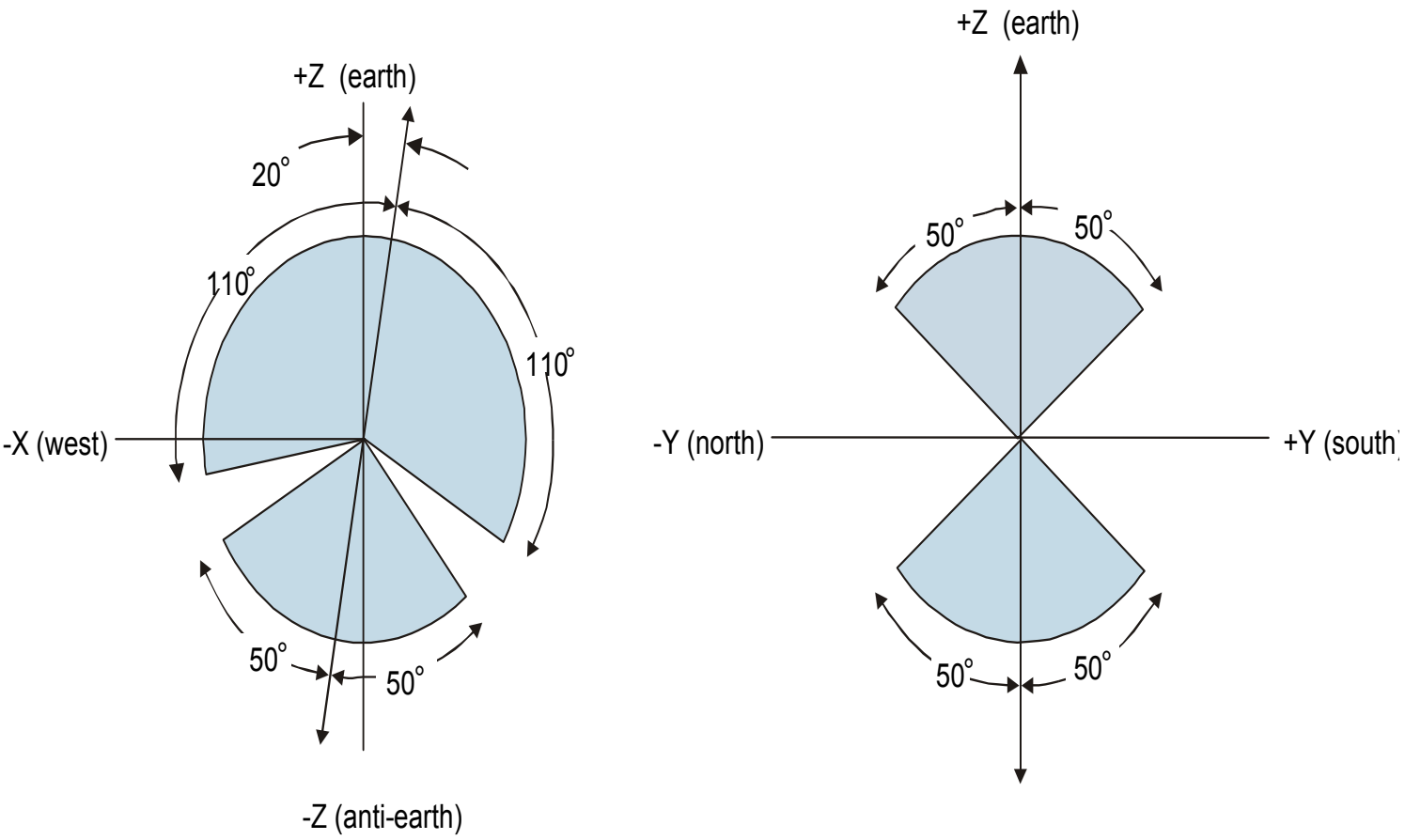


Figure B-3. Coverage Pattern of Wide-area TT&C Beams

APPENDIX C

TT&C Link Budgets

Table C-1. On-Station Telemetry Link Budget

DIRECTV 8 On-station Telemetry	CRK/LA Comm. Antenna	Units
Frequency	12.2	GHz
TWTA output power	-4.0	dBW
Total transmit losses	-7.7	dB
Antenna gain	30.0	dB
EIRP	**18.3**	dBW
Required	**12.0**	dBW
Margin	**6.3**	dB

Table C-2. On-Station Command Link Budget

DIRECTV 8 On-station Command, EOC	Hi U/L	Lo U/L	Units
Frequency	17.3	17.3	GHz
Incident flux density	-50.0	-102.0	dBW/m^2
Isotropic area	-46.2	-46.2	dB-m^2
Antenna gain	30.0	30.0	dB
Total receive losses	-16.0	-16.0	dB
Command receiver input power	**-52.2**	**-104.2**	dBm
Command receiver threshold		**-112.0**	dBm
Margin		**7.8**	dB
Command receiver max input power	**-35.0**		dBm
Margin	**17.2**		dB

ANNEX 1

ITU Radio Regulations Appendix 30 and 30A Interference Analyses

ANNEX 1 TO APPENDIX 30 FOR DIRECTV 8 (USABSS-19)

1 Limits for the interference into frequency assignments in conformity with the Regions 1 and 3 Plan or with the Regions 1 and 3 List or into new or modified assignments in the Regions 1 and 3 List

Not Applicable to Region 2 modifications.

2 Limits to the change in the overall equivalent protection margin for frequency assignments in conformity with the Region 2 Plan

With respect to § 4.2.3 c) of Article 4, an administration in Region 2 is considered as being affected if the overall equivalent protection margin[17] corresponding to a test point of its entry in the Region 2 Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:

– *the Region 2 Plan as established by the 1983 Conference; or*

– *a modification of the assignment in accordance with this Appendix; or*

– *a new entry in the Region 2 Plan under Article 4; or*

– *any agreement reached in accordance with this Appendix. (WRC-03)*

A detailed interference analysis was performed using the ITU's MSPACEg program. Input beams were created for networks in the orbital neighborhood of DIRECTV 8 that are filed with the BR but not yet published. These include, but are not limited to, USAT-S1 MOD-A, USAT-S2, IOMBSS-1, Echo 7, and Echo 8.

The analysis shows that no networks are affected by DIRECTV 8. The findings file for the MSPACE run is included at the end of this annex. DIRECTV 8 is in compliance with Section 2.

3 Limits to the change in the power flux-density to protect the broadcasting-satellite service in Regions 1 and 2 in the band 12.2-12.5 GHz and in Region 3 in the band 12.5-12.7 GHz

With respect to § 4.2.3 a), 4.2.3 b) or 4.2.3 f) of Article 4, as appropriate, an administration in Region 1 or 3 is considered as being affected if the proposed modification to the Region 2 Plan would result in exceeding the following power flux-density values, at any test point in the service area of its overlapping frequency assignments:

-147 dB(W/(m^2 · 27 MHz))	for $0° \le \theta < 0.23°$
$-135.7 + 17.74 \log \theta$ dB(W/(m^2 · 27 MHz))	for $0.23° \le \theta < 2.0°$
$-136.7 + 1.66\ \theta^2$ dB(W/(m^2 · 27 MHz))	for $2.0° \le \theta < 3.59°$
$-129.2 + 25 \log \theta$ dB(W/(m^2 · 27 MHz))	for $3.59° \le \theta < 10.57°$

-103.6 dB(W/(m^2 · 27 MHz)) for 10.57° ≤ θ

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies. (WRC-03)

The closest Regions 1 and 3 BSS orbital location in the Regions 1 and 3 Plan or List is the French OCE10100 assignment at 160°W, which is 59° from the 101°W orbital location of DIRECTV 8. Therefore, the -103.6 dBW/m^2/27 MHz power flux density limit applies in this case.

The maximum EIRP for DIRECTV 8 is 57.3 dBW, which corresponds to a PFD of -105.2 dBW/m^2/27 MHz. The PFDPFD limit of -103.6 dBW/m^2/27 MHz is not exceeded anywhere on the earth's surface. Therefore, DIRECTV 8 will comply with Section 3.

4 Limits to the power flux-density to protect the terrestrial services of other administrations[18, 19, 20]

With respect to § 4.1.1 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the consequence of the proposed modified assignment in the Regions 1 and 3 List is to increase the power flux-density arriving on any part of the territory of that administration by more than 0.25 dB over that resulting from that frequency assignment in the Plan or List for Regions 1 and 3 as established by WRC-2000. The same administration is considered as not being affected if the value of the power flux-density anywhere in its territory does not exceed the limits expressed below.

With respect to § 4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the consequence of the proposed modification to an existing assignment in the Region 2 Plan is to increase the power flux-density arriving on any part of the territory of that administration by more than 0.25 dB over that resulting from that frequency assignment in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference. The same administration is considered as not being affected if the value of the power flux-density anywhere in its territory does not exceed the limits expressed below.

With respect to § 4.1.1 d) or § 4.2.3 d) of Article 4, an administration in Region 1, 2 or 3 is considered as being affected if the proposed new assignment in the Regions 1 and 3 List, or if the proposed new frequency assignment in the Region 2 Plan, would result in exceeding a power flux-density, for any angle of arrival, at any point on its territory, of:

-148 dB(W/(m^2 · 4 kHz)) for θ ≤ 5°

-148 + 0.5 (θ - 5) dB(W(m^2 · 4 kHz) for 5° < θ ≤ 25°

-138 dB(W/(m^2 · 4 kHz)) for 25° < θ ≤ 90°

where θ represents the angle of arrival. (WRC-03)

The following table shows the calculated PFD level using the *minimum* isolation of DIRECTV 8 towards Regions 1 and 3 territories, as shown in Figure 1. This PFD is below the most stringent PFD level in Section 4.

DIRECTV 8 Peak EIRP (dBW/24 MHz)	57.3
Minimum Isolation to R1 & R3 (dB)	15
Calculated PFD (dBW/$m^2 \cdot$4 kHz)	-157.9
Section 4 PFD Limit (dBW/m^2.4 kHz)	-148
Margin (dB)	9.9

Consistent with provision 4.2.3 d) of Article 4 of Appendix 30, these PFD limits apply to countires not having frequency assignment in the broadcasting-satellite service in the channel concerned. Since both Canada and Mexico, among other Region 2 countries, are assigned all 32 channels in the Plan, and therefore, will not be deploying terrestrial services, Section 4 limits do not need to be met on their territories.

For other Region 2 countries, PFD values were obtained using the ITU GIMS program and the GIMS PFD Tool. PFD values of DIRECTV 8 were obtained for Region 2 territories for the three cases listed above: with look angles to DIRECTV 8 of less than 5 degrees, look angles between 5 and 25 degrees, and look angles between 25 and 90 degrees.

Figure 1 shows elevation contours of 5 and 25 degrees as seen from 100.85° W.L. This figure shows the territories that lie at elevation angles for the three cases to be examined, and the antenna contours which are used to determine the off-axis gain value.

$\theta \leq 5°$

The minimum isolation to a Region 2 territory with less than 5 degree elevation angle is 15 dB. As shown in the table above, this yields a maximum PFD of -157.9 dBW/$m^2 \cdot$ 4 kHz, which is below the limit of -148 dBW/$m^2 \cdot$ 4 kHz.

$5° < \theta \leq 25°$

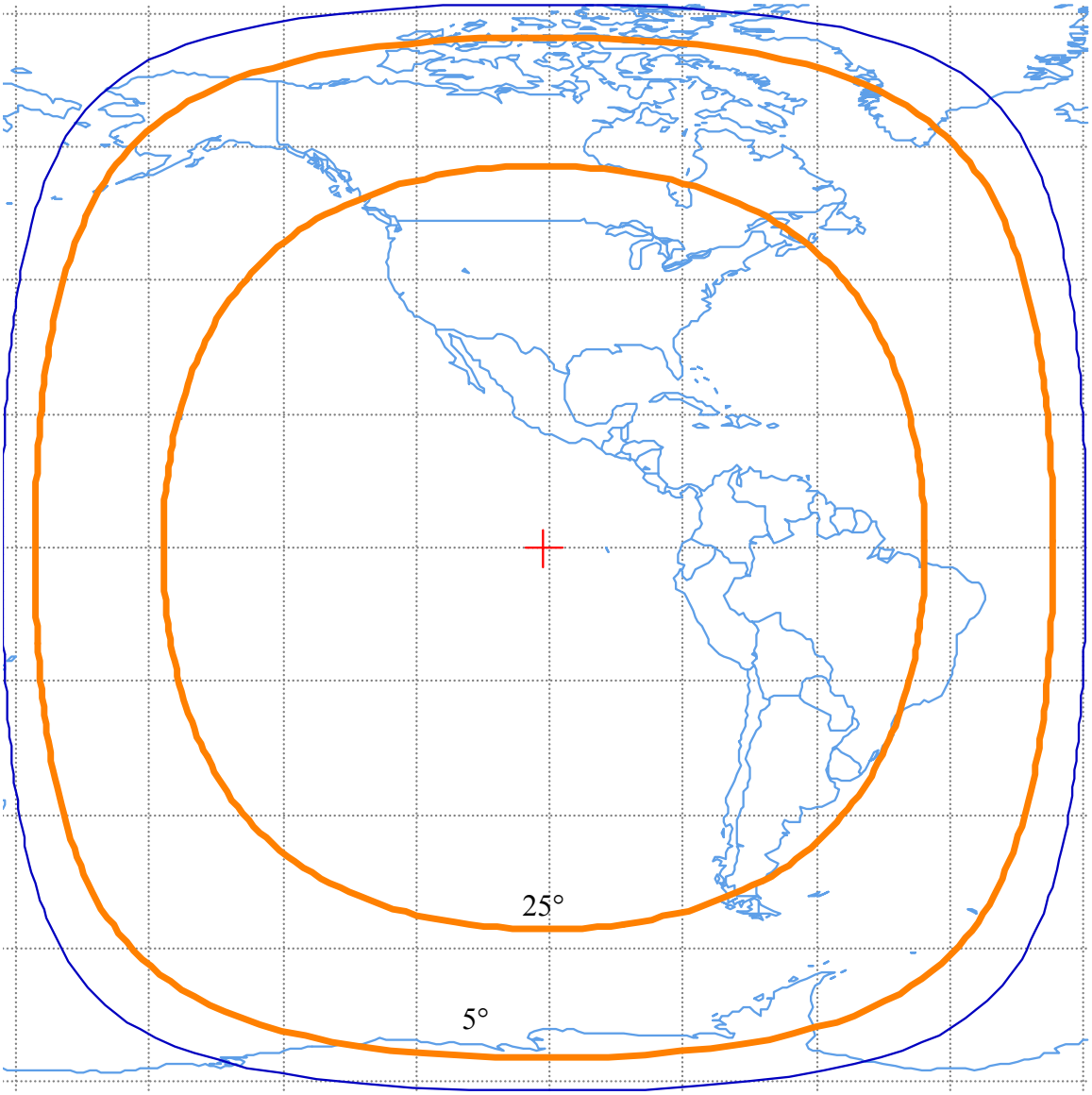
For Region 2 territories with elevation angles between 5 and 25 degrees, the minimum isolation is 30 dB, which yields a maximum PFD of -172.9 dBW/$m^2 \cdot$ 4 kHz, which is below the strictest limit of -148 dBW/$m^2 \cdot$ 4 kHz.

$25° < \theta \leq 90°$

The maximum DIRECTV 8 PFD anywhere on the surface of the Earth is -142.9 dBW/$m^2 \cdot$ 4 kHz. This is below the limit of -138 dBW/$m^2 \cdot$ 4 kHz.

DIRECTV 8 meets the PFD limits of Section 4 for all cases of Regions 1, 2 and 3 territories, and is therefore in compliance with Section 4.

Figure 1. 5 and 25 Degree Elevation Angles from 100.85° W.L.



6 Limits to the change in the power flux-density of assignments in the Regions 1 and 3 Plan or List to protect the fixed-satellite service (space-to-Earth) in the band 11.7-12.2 GHz[21] in Region 2 or in the band 12.2-12.5 GHz in Region 3, and of assignments in the Region 2 Plan to protect the fixed-satellite service (space-to-Earth) in the band 12.5-12.7 GHz in Region 1 and in the band 12.2-12.7 GHz in Region 3

[21] Including assignments operating under No. **5.485** of the Radio Regulations.

With respect to § 4.1.1 e) of Article 4, an administration is considered as being affected if the proposed new or modified assignment in the Regions 1 and 3 List would result in an increase in the power flux-density over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 2 or Region 3 of 0.25 dB or more above that resulting from the frequency assignments in the Plan or List for Regions 1 and 3 as established by WRC-2000.

With respect to § 4.2.3 e), an administration is considered as being affected if the proposed modification to the Region 2 Plan would result in an increase in the power flux-density over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1 or 3 of 0.25 dB or more above that resulting from the frequency assignments in the Region 2 Plan at the time of entry into force of the Final Acts of the 1985 Conference.

With respect to § 4.1.1 e) or 4.2.3 e) of Article 4, with the exception of cases covered by Note 1 below, an administration is considered as not being affected if the proposed new or modified assignment in the Regions 1 and 3 List, or if a proposed modification to the Region 2 Plan, gives a power flux-density anywhere over any portion of the service area of its overlapping frequency assignments in the fixed-satellite service in Region 1, 2 or 3 of less than:

-186.5 dB(W/(m^2 · 40 kHz))	for	$0° \le \theta < 0.054°$
$-164.0 + 17.74 \log \theta$ dB(W/(m^2 · 40 kHz))	for	$0.054° \le \theta < 2.0°$
$-165.0 + 1.66 \theta^2$ dB(W/(m^2 · 40 kHz))	for	$2.0° \le \theta < 3.59°$
$-157.5 + 25 \log \theta$ dB(W/(m^2 · 40 kHz))	for	$3.59° \le \theta < 10.57°$
-131.9 dB(W/(m^2 · 40 kHz))	for	$10.57° \le \theta$

where θ is the minimum geocentric orbital separation in degrees between the wanted and interfering space stations, taking into account the respective East-West station-keeping accuracies.

All Regions 1 and 3 FSS satellites are greater than 10.57 degrees from 101° W.L., therefore the -131.9 dB(W/(m^2 · 40 kHz)) level applies. As shown in Section 4, the maximum PFD of DIRECTV 8 anywhere on the surface of the Earth is -142.9 dBW/m^2 · 4 kHz, or -132.9 dBW/m^2 · 40 kHz. This is below the limit of -131.9 dB(W/(m^2 · 40 kHz)) Therefore, DIRECTV 8 is in compliance with Section 6.

7 Limits to the change in equivalent noise temperature to protect the fixed-satellite service (Earth-to-space) in Region 1 from modifications to the Region 2 Plan in the band 12.5-12.7 GHz

With respect to § 4.2.3 e) of Article 4, an administration of Region 1 is considered as being affected if the proposed modification to the Region 2 Plan would result in:

– *the value of ΔT/T resulting from the proposed modification is greater than the value of ΔT/T resulting from the assignment in the Region 2 Plan as of the date of entry into force of the Final Acts of the 1985 Conference; and*

– *the value of ΔT/T resulting from the proposed modification exceeds 6%, using the method of Appendix **8** (Case II). (WRC-03)*

A review of the available ITU space network databases shows that there are no assignments registered in the Earth-to-space direction in the frequency band 12.5-12.7 GHz. Therefore, no Region 1 space stations can be affected, and DIRECTV 8 is in compliance with Section 7.

ANNEX 1 TO APPENDIX 30A FOR DIRECTV 8 (USABSS-19)

1 Not used.

2 Not used.

3 Limits to the change in the overall equivalent protection margin with respect to frequency assignments in conformity with the Region 2 feeder-link Plan[18] (WRC-2000)

*With respect to the modification to the Region 2 feeder-link Plan and when it is necessary under this Appendix to seek the agreement of any other administration of Region 2, except in cases covered by Resolution **42 (Rev.WRC-03)**, an administration is considered as being affected if the overall equivalent protection margin[19] corresponding to a test point of its entry in that Plan, including the cumulative effect of any previous modification to that Plan or any previous agreement, falls more than 0.25 dB below 0 dB, or, if already negative, more than 0.25 dB below the value resulting from:*

– *the feeder-link Plan as established by the 1983 Conference; or*

– *a modification of the assignment in accordance with this Appendix; or*

– *a new entry in the feeder-link Plan under Article 4; or*

– *any agreement reached in accordance with this Appendix except for Resolution **42 (Rev.WRC-03)**. (WRC-03)*

A detailed interference analysis was performed using the ITU's MSPACEg program. Input beams were created for networks in the orbital neighborhood of DIRECTV 8 that are filed with the BR but not yet published. These include, but are not limited to, USAT-S1 MOD-A, USAT-S2, IOMBSS-1, Echo 7 and Echo 8.

The analysis shows that no networks are affected by DIRECTV 8. The findings file for the MSPACE run is included at the end of this annex. DIRECTV 8 is in compliance with Section 3.

4 Limits to the interference into frequency assignments in conformity with the Regions 1 and 3 feeder-link Plan or with the Regions 1 and 3 feeder-link List or proposed new or modified assignments in the Regions 1 and 3 feeder-link List (WRC-03)

Not applicable to Region 2 modifications.

5 Limits applicable to protect a frequency assignment in the bands 17.3-18.1 GHz (Regions 1 and 3) and 17.3-17.8 GHz (Region 2) to a receiving space station in the fixed-satellite service (Earth-to-space)

*An administration in Region 1 or 3 is considered as being affected by a proposed modification in Region 2, with respect to § 4.2.2 a) or 4.2.2 b) of Article 4, or an administration in Region 2 is considered as being affected by a proposed new or modified assignment in the Regions 1 and 3 feeder-link List, with respect to § 4.1.1 c) of Article 4, when the power flux-density arriving at the receiving space station of a broadcasting-satellite feeder-link would cause an increase in the noise temperature of the feeder-link space station which exceeds the threshold value of ΔT/T corresponding to 6%, where ΔT/T is calculated in accordance with the method given in Appendix **8**, except that the maximum power densities per hertz averaged over the worst 1 MHz are replaced by power densities per hertz averaged over the necessary bandwidth of the feeder-link carriers. (WRC-03)*

*Interim systems of Region 2 in accordance with Resolution **42 (Rev.WRC-03)** shall not be taken into consideration when applying the above paragraph to proposed new or modified assignments in the Regions 1 and 3 feeder-link List. However, the above paragraph shall be applied to Region 2 interim systems with respect to Regions 1 and 3 administrations, referred to in § 5.2 b) of Resolution **42 (Rev.WRC-03)**. (WRC-03)*

Delta T/T values were calculated in accordance with Appendix 8 for several Region 1 and 3 assignments close to DIRECTV 8, for both the Los Angeles and Castle Rock Broadcast Centers. The table below shows that interference levels are all well below the limit of 6%. DIRECTV 8 is in compliance with Section 5.

R1/R3 Network	Orbital Position, W	Orbital separation from D8	Rcv Noise Temp	Rcv ant. max gain (GIMS)	Rcv ant. min. off-axis disc. towards FL (GIMS)	D8 FL EIRP	D8 FL gain toward victim (25.209)	FS Loss	Delta T/T, %
OCE10100	160.0	59.0	900	32.6	-25.0	78.0	-10	209.5	**6.5E-06**
FJI19300	178.0	77.0	900	44.2	-30.0	78.0	-10	209.5	**3.0E-05**
SMO05700	178.0	77.0	900	48.9	-30.0	78.0	-10	209.5	**8.8E-05**
IRL21100*	37.2	63.8	900	48.1	-30.0	78.0	-10	209.5	**7.3E-05**
NGR11500*	37.2	63.8	900	38.5	-30.0	78.0	-10	209.5	**8.0E-06**
AND34100*	37.0	64.0	900	48.9	-30.0	78.0	-10	209.5	**8.8E-05**
GMB30200*	37.0	64.0	900	47.7	-30.0	78.0	-10	209.5	**6.7E-05**
GUI19200*	37.0	64.0	900	42.3	-30.0	78.0	-10	209.5	**1.9E-05**
POR_100*	37.0	64.0	900	47.2	-30.0	78.0	-10	209.5	**5.9E-05**
MTN100*	36.8	64.2	900	37.6	-30.0	78.0	-10	209.5	**6.5E-06**
SMR31100*	36.8	64.2	900	48.9	-30.0	78.0	-10	209.5	**8.8E-05**
CPV30100*	33.5	67.5	900	47.6	-30.0	78.0	-10	209.5	**6.5E-05**
DNK090XR*	33.5	67.5	900	44.1	-30.0	78.0	-10	209.5	**2.9E-05**
DNK091XR*	33.5	67.5	900	44.9	-30.0	78.0	-10	209.5	**3.5E-05**
G02700*	33.5	67.5	900	43.2	-30.0	78.0	-10	209.5	**2.4E-05**
ISL04900*	33.5	67.5	900	46.7	-30.0	78.0	-10	209.5	**5.3E-05**
ISL05000*	33.5	67.5	900	44.7	-30.0	78.0	-10	209.5	**3.4E-05**
LBR24400*	33.5	67.5	900	45.2	-30.0	78.0	-10	209.5	**3.8E-05**

* = network not visible from Los Angeles Broadcast Center

6 Limits applicable to protect a frequency assignment in the band 17.8-18.1 GHz (Region 2) to a receiving feeder-link space station in the fixed-satellite service (Earth-to-space) (WRC-03)

Not applicable to Region 2 modifications.

MSPACE Findings File for DIRECTV 8

```
MSPACEG Version 4.000 (MS Windows)                      25.06.2004  21:46:14
 ITU Appendices S30 & S30A Analysis in Region 2
        ONLY  VISIBLE  TEST  POINTS  INCLUDED     DOWN  AND  UP  LINK  SAT83  REGION  2  PLAN
Version: 28 May 2002       X
```

(Tolerance for margin degradation is 0.25 dB)

				Overall Equivalent Protection Margins (dB)				
Beam	Pos	Chan	TP	Clear Sky	Rain Faded	Worst Case	Reference	Decrease
DRCTV845	-100.8	1	1	-13.46	-13.34	-13.46	0.00	-13.46
DRCTV845	-100.8	1	2	-13.50	-13.37	-13.50	0.00	-13.50
DRCTV845	-100.8	1	3	-13.34	-13.17	-13.34	0.00	-13.34
DRCTV845	-100.8	1	4	-13.94	-13.82	-13.94	0.00	-13.94
DRCTV845	-100.8	1	5	-13.89	-13.78	-13.89	0.00	-13.89
DRCTV845	-100.8	1	6	-13.54	-13.33	-13.54	0.00	-13.54
DRCTV845	-100.8	1	7	-14.61	-14.36	-14.61	0.00	-14.61
DRCTV845	-100.8	1	8	-14.22	-14.04	-14.22	0.00	-14.22
DRCTV845	-100.8	1	9	-13.34	-13.18	-13.34	0.00	-13.34
DRCTV845	-100.8	1	10	-14.61	-14.53	-14.61	0.00	-14.61
DRCTV845	-100.8	1	11	-14.52	-14.38	-14.52	0.00	-14.52
DRCTV845	-100.8	1	12	-12.99	-12.74	-12.99	0.00	-12.99
DRCTV845	-100.8	1	13	-13.58	-13.47	-13.58	0.00	-13.58
DRCTV845	-100.8	1	14	-15.26	-15.16	-15.26	0.00	-15.26
DRCTV845	-100.8	1	15	-13.86	-13.79	-13.86	0.00	-13.86
DRCTV845	-100.8	1	16	-13.31	-13.20	-13.31	0.00	-13.31
DRCTV845	-100.8	1	17	-12.94	-12.86	-12.94	0.00	-12.94
DRCTV845	-100.8	1	18	-12.99	-12.93	-12.99	0.00	-12.99
DRCTV845	-100.8	1	19	-12.04	-11.96	-12.04	0.00	-12.04
DRCTV845	-100.8	1	20	-22.24	-22.17	-22.24	0.00	-22.24
DRCTV845	-100.8	3	1	-13.72	-13.60	-13.72	0.00	-13.72
DRCTV845	-100.8	3	2	-13.76	-13.63	-13.76	0.00	-13.76
DRCTV845	-100.8	3	3	-13.60	-13.43	-13.60	0.00	-13.60
DRCTV845	-100.8	3	4	-14.19	-14.07	-14.19	0.00	-14.19
DRCTV845	-100.8	3	5	-14.14	-14.03	-14.14	0.00	-14.14
DRCTV845	-100.8	3	6	-13.79	-13.59	-13.79	0.00	-13.79
DRCTV845	-100.8	3	7	-14.84	-14.60	-14.84	0.00	-14.84
DRCTV845	-100.8	3	8	-14.46	-14.28	-14.46	0.00	-14.46
DRCTV845	-100.8	3	9	-13.57	-13.42	-13.57	0.00	-13.57
DRCTV845	-100.8	3	10	-14.80	-14.72	-14.80	0.00	-14.80
DRCTV845	-100.8	3	11	-14.71	-14.57	-14.71	0.00	-14.71
DRCTV845	-100.8	3	12	-13.24	-13.00	-13.24	0.00	-13.24
DRCTV845	-100.8	3	13	-13.79	-13.69	-13.79	0.00	-13.79
DRCTV845	-100.8	3	14	-15.44	-15.34	-15.44	0.00	-15.44
DRCTV845	-100.8	3	15	-14.09	-14.02	-14.09	0.00	-14.09
DRCTV845	-100.8	3	16	-13.53	-13.42	-13.53	0.00	-13.53
DRCTV845	-100.8	3	17	-13.11	-13.03	-13.11	0.00	-13.11
DRCTV845	-100.8	3	18	-13.15	-13.09	-13.15	0.00	-13.15
DRCTV845	-100.8	3	19	-12.32	-12.24	-12.32	0.00	-12.32
DRCTV845	-100.8	3	20	-22.35	-22.29	-22.35	0.00	-22.35
DRCTV845	-100.8	5	1	-13.64	-13.52	-13.64	0.00	-13.64
DRCTV845	-100.8	5	2	-13.75	-13.63	-13.75	0.00	-13.75
DRCTV845	-100.8	5	3	-13.47	-13.30	-13.47	0.00	-13.47
DRCTV845	-100.8	5	4	-14.15	-14.03	-14.15	0.00	-14.15
DRCTV845	-100.8	5	5	-14.11	-14.00	-14.11	0.00	-14.11
DRCTV845	-100.8	5	6	-13.76	-13.56	-13.76	0.00	-13.76
DRCTV845	-100.8	5	7	-14.79	-14.55	-14.79	0.00	-14.79
DRCTV845	-100.8	5	8	-14.42	-14.24	-14.42	0.00	-14.42
DRCTV845	-100.8	5	9	-13.51	-13.35	-13.51	0.00	-13.51
DRCTV845	-100.8	5	10	-14.72	-14.64	-14.72	0.00	-14.72
DRCTV845	-100.8	5	11	-14.67	-14.53	-14.67	0.00	-14.67
DRCTV845	-100.8	5	12	-13.18	-12.93	-13.18	0.00	-13.18
DRCTV845	-100.8	5	13	-13.75	-13.64	-13.75	0.00	-13.75
DRCTV845	-100.8	5	14	-15.36	-15.25	-15.36	0.00	-15.36
DRCTV845	-100.8	5	15	-14.05	-13.97	-14.05	0.00	-14.05
DRCTV845	-100.8	5	16	-13.46	-13.35	-13.46	0.00	-13.46
DRCTV845	-100.8	5	17	-13.13	-13.05	-13.13	0.00	-13.13

DRCTV845	-100.8	5	18	-13.18	-13.13	-13.18	0.00	-13.18
DRCTV845	-100.8	5	19	-12.31	-12.23	-12.31	0.00	-12.31
DRCTV845	-100.8	5	20	-22.26	-22.20	-22.26	0.00	-22.26
DRCTV845	-100.8	7	1	-13.68	-13.56	-13.68	0.00	-13.68
DRCTV845	-100.8	7	2	-13.81	-13.68	-13.81	0.00	-13.81
DRCTV845	-100.8	7	3	-13.51	-13.34	-13.51	0.00	-13.51
DRCTV845	-100.8	7	4	-14.19	-14.07	-14.19	0.00	-14.19
DRCTV845	-100.8	7	5	-14.15	-14.04	-14.15	0.00	-14.15
DRCTV845	-100.8	7	6	-13.80	-13.60	-13.80	0.00	-13.80
DRCTV845	-100.8	7	7	-14.83	-14.59	-14.83	0.00	-14.83
DRCTV845	-100.8	7	8	-14.47	-14.29	-14.47	0.00	-14.47
DRCTV845	-100.8	7	9	-13.57	-13.41	-13.57	0.00	-13.57
DRCTV845	-100.8	7	10	-14.80	-14.72	-14.80	0.00	-14.80
DRCTV845	-100.8	7	11	-14.70	-14.56	-14.70	0.00	-14.70
DRCTV845	-100.8	7	12	-13.24	-13.00	-13.24	0.00	-13.24
DRCTV845	-100.8	7	13	-13.79	-13.69	-13.79	0.00	-13.79
DRCTV845	-100.8	7	14	-15.44	-15.34	-15.44	0.00	-15.44
DRCTV845	-100.8	7	15	-14.09	-14.02	-14.09	0.00	-14.09
DRCTV845	-100.8	7	16	-13.53	-13.42	-13.53	0.00	-13.53
DRCTV845	-100.8	7	17	-13.12	-13.03	-13.12	0.00	-13.12
DRCTV845	-100.8	7	18	-13.15	-13.09	-13.15	0.00	-13.15
DRCTV845	-100.8	7	19	-12.32	-12.24	-12.32	0.00	-12.32
DRCTV845	-100.8	7	20	-22.35	-22.29	-22.35	0.00	-22.35
DRCTV845	-100.8	9	1	-13.62	-13.50	-13.62	0.00	-13.62
DRCTV845	-100.8	9	2	-13.76	-13.63	-13.76	0.00	-13.76
DRCTV845	-100.8	9	3	-13.48	-13.31	-13.48	0.00	-13.48
DRCTV845	-100.8	9	4	-14.15	-14.03	-14.15	0.00	-14.15
DRCTV845	-100.8	9	5	-14.10	-13.99	-14.10	0.00	-14.10
DRCTV845	-100.8	9	6	-13.75	-13.55	-13.75	0.00	-13.75
DRCTV845	-100.8	9	7	-14.78	-14.54	-14.78	0.00	-14.78
DRCTV845	-100.8	9	8	-14.41	-14.23	-14.41	0.00	-14.41
DRCTV845	-100.8	9	9	-13.51	-13.35	-13.51	0.00	-13.51
DRCTV845	-100.8	9	10	-14.72	-14.64	-14.72	0.00	-14.72
DRCTV845	-100.8	9	11	-14.67	-14.53	-14.67	0.00	-14.67
DRCTV845	-100.8	9	12	-13.18	-12.93	-13.18	0.00	-13.18
DRCTV845	-100.8	9	13	-13.75	-13.64	-13.75	0.00	-13.75
DRCTV845	-100.8	9	14	-15.36	-15.25	-15.36	0.00	-15.36
DRCTV845	-100.8	9	15	-14.00	-13.93	-14.00	0.00	-14.00
DRCTV845	-100.8	9	16	-13.51	-13.40	-13.51	0.00	-13.51
DRCTV845	-100.8	9	17	-13.12	-13.04	-13.12	0.00	-13.12
DRCTV845	-100.8	9	18	-13.17	-13.12	-13.17	0.00	-13.17
DRCTV845	-100.8	9	19	-12.25	-12.18	-12.25	0.00	-12.25
DRCTV845	-100.8	9	20	-22.27	-22.20	-22.27	0.00	-22.27
DRCTV845	-100.8	11	1	-13.70	-13.58	-13.70	0.00	-13.70
DRCTV845	-100.8	11	2	-13.81	-13.69	-13.81	0.00	-13.81
DRCTV845	-100.8	11	3	-13.55	-13.38	-13.55	0.00	-13.55
DRCTV845	-100.8	11	4	-14.19	-14.07	-14.19	0.00	-14.19
DRCTV845	-100.8	11	5	-14.17	-14.06	-14.17	0.00	-14.17
DRCTV845	-100.8	11	6	-13.80	-13.60	-13.80	0.00	-13.80
DRCTV845	-100.8	11	7	-14.83	-14.59	-14.83	0.00	-14.83
DRCTV845	-100.8	11	8	-14.46	-14.29	-14.46	0.00	-14.46
DRCTV845	-100.8	11	9	-13.58	-13.42	-13.58	0.00	-13.58
DRCTV845	-100.8	11	10	-14.80	-14.72	-14.80	0.00	-14.80
DRCTV845	-100.8	11	11	-14.71	-14.57	-14.71	0.00	-14.71
DRCTV845	-100.8	11	12	-13.25	-13.01	-13.25	0.00	-13.25
DRCTV845	-100.8	11	13	-13.80	-13.69	-13.80	0.00	-13.80
DRCTV845	-100.8	11	14	-15.45	-15.34	-15.45	0.00	-15.45
DRCTV845	-100.8	11	15	-14.07	-14.00	-14.07	0.00	-14.07
DRCTV845	-100.8	11	16	-13.53	-13.43	-13.53	0.00	-13.53
DRCTV845	-100.8	11	17	-13.11	-13.03	-13.11	0.00	-13.11
DRCTV845	-100.8	11	18	-13.15	-13.09	-13.15	0.00	-13.15
DRCTV845	-100.8	11	19	-12.30	-12.22	-12.30	0.00	-12.30
DRCTV845	-100.8	11	20	-22.36	-22.29	-22.36	0.00	-22.36
DRCTV845	-100.8	13	1	-13.67	-13.55	-13.67	0.00	-13.67
DRCTV845	-100.8	13	2	-13.77	-13.65	-13.77	0.00	-13.77
DRCTV845	-100.8	13	3	-13.52	-13.35	-13.52	0.00	-13.52
DRCTV845	-100.8	13	4	-14.16	-14.04	-14.16	0.00	-14.16
DRCTV845	-100.8	13	5	-14.14	-14.03	-14.14	0.00	-14.14
DRCTV845	-100.8	13	6	-13.77	-13.57	-13.77	0.00	-13.77
DRCTV845	-100.8	13	7	-14.78	-14.54	-14.78	0.00	-14.78
DRCTV845	-100.8	13	8	-14.42	-14.24	-14.42	0.00	-14.42
DRCTV845	-100.8	13	9	-13.53	-13.37	-13.53	0.00	-13.53
DRCTV845	-100.8	13	10	-14.73	-14.65	-14.73	0.00	-14.73
DRCTV845	-100.8	13	11	-14.67	-14.53	-14.67	0.00	-14.67

DRCTV845	-100.8	13	12	-13.19	-12.94	-13.19	0.00	-13.19
DRCTV845	-100.8	13	13	-13.76	-13.65	-13.76	0.00	-13.76
DRCTV845	-100.8	13	14	-15.37	-15.26	-15.37	0.00	-15.37
DRCTV845	-100.8	13	15	-14.01	-13.94	-14.01	0.00	-14.01
DRCTV845	-100.8	13	16	-13.47	-13.37	-13.47	0.00	-13.47
DRCTV845	-100.8	13	17	-13.13	-13.05	-13.13	0.00	-13.13
DRCTV845	-100.8	13	18	-13.18	-13.13	-13.18	0.00	-13.18
DRCTV845	-100.8	13	19	-12.27	-12.19	-12.27	0.00	-12.27
DRCTV845	-100.8	13	20	-22.27	-22.20	-22.27	0.00	-22.27
DRCTV845	-100.8	15	1	-13.71	-13.59	-13.71	0.00	-13.71
DRCTV845	-100.8	15	2	-13.81	-13.68	-13.81	0.00	-13.81
DRCTV845	-100.8	15	3	-13.56	-13.39	-13.56	0.00	-13.56
DRCTV845	-100.8	15	4	-14.20	-14.08	-14.20	0.00	-14.20
DRCTV845	-100.8	15	5	-14.18	-14.07	-14.18	0.00	-14.18
DRCTV845	-100.8	15	6	-13.81	-13.61	-13.81	0.00	-13.81
DRCTV845	-100.8	15	7	-14.84	-14.60	-14.84	0.00	-14.84
DRCTV845	-100.8	15	8	-14.47	-14.29	-14.47	0.00	-14.47
DRCTV845	-100.8	15	9	-13.59	-13.43	-13.59	0.00	-13.59
DRCTV845	-100.8	15	10	-14.81	-14.72	-14.81	0.00	-14.81
DRCTV845	-100.8	15	11	-14.70	-14.57	-14.70	0.00	-14.70
DRCTV845	-100.8	15	12	-13.25	-13.01	-13.25	0.00	-13.25
DRCTV845	-100.8	15	13	-13.80	-13.70	-13.80	0.00	-13.80
DRCTV845	-100.8	15	14	-15.45	-15.35	-15.45	0.00	-15.45
DRCTV845	-100.8	15	15	-14.08	-14.01	-14.08	0.00	-14.08
DRCTV845	-100.8	15	16	-13.52	-13.41	-13.52	0.00	-13.52
DRCTV845	-100.8	15	17	-13.12	-13.04	-13.12	0.00	-13.12
DRCTV845	-100.8	15	18	-13.16	-13.09	-13.16	0.00	-13.16
DRCTV845	-100.8	15	19	-12.31	-12.23	-12.31	0.00	-12.31
DRCTV845	-100.8	15	20	-22.36	-22.29	-22.36	0.00	-22.36
DRCTV845	-100.8	17	1	-13.87	-13.75	-13.87	0.00	-13.87
DRCTV845	-100.8	17	2	-13.97	-13.84	-13.97	0.00	-13.97
DRCTV845	-100.8	17	3	-13.71	-13.54	-13.71	0.00	-13.71
DRCTV845	-100.8	17	4	-14.38	-14.26	-14.38	0.00	-14.38
DRCTV845	-100.8	17	5	-14.35	-14.24	-14.35	0.00	-14.35
DRCTV845	-100.8	17	6	-13.98	-13.77	-13.98	0.00	-13.98
DRCTV845	-100.8	17	7	-15.03	-14.78	-15.03	0.00	-15.03
DRCTV845	-100.8	17	8	-14.65	-14.47	-14.65	0.00	-14.65
DRCTV845	-100.8	17	9	-13.75	-13.59	-13.75	0.00	-13.75
DRCTV845	-100.8	17	10	-15.02	-14.94	-15.02	0.00	-15.02
DRCTV845	-100.8	17	11	-14.90	-14.77	-14.90	0.00	-14.90
DRCTV845	-100.8	17	12	-13.41	-13.16	-13.41	0.00	-13.41
DRCTV845	-100.8	17	13	-13.98	-13.87	-13.98	0.00	-13.98
DRCTV845	-100.8	17	14	-15.68	-15.57	-15.68	0.00	-15.68
DRCTV845	-100.8	17	15	-14.27	-14.20	-14.27	0.00	-14.27
DRCTV845	-100.8	17	16	-13.69	-13.59	-13.69	0.00	-13.69
DRCTV845	-100.8	17	17	-13.34	-13.26	-13.34	0.00	-13.34
DRCTV845	-100.8	17	18	-13.39	-13.34	-13.39	0.00	-13.39
DRCTV845	-100.8	17	19	-12.47	-12.39	-12.47	0.00	-12.47
DRCTV845	-100.8	17	20	-22.63	-22.56	-22.63	0.00	-22.63
DRCTV845	-100.8	19	1	-13.92	-13.80	-13.92	0.00	-13.92
DRCTV845	-100.8	19	2	-14.02	-13.89	-14.02	0.00	-14.02
DRCTV845	-100.8	19	3	-13.77	-13.59	-13.77	0.00	-13.77
DRCTV845	-100.8	19	4	-14.43	-14.30	-14.43	0.00	-14.43
DRCTV845	-100.8	19	5	-14.41	-14.29	-14.41	0.00	-14.41
DRCTV845	-100.8	19	6	-14.02	-13.81	-14.02	0.00	-14.02
DRCTV845	-100.8	19	7	-15.08	-14.83	-15.08	0.00	-15.08
DRCTV845	-100.8	19	8	-14.70	-14.52	-14.70	0.00	-14.70
DRCTV845	-100.8	19	9	-13.79	-13.62	-13.79	0.00	-13.79
DRCTV845	-100.8	19	10	-15.03	-14.95	-15.03	0.00	-15.03
DRCTV845	-100.8	19	11	-14.92	-14.78	-14.92	0.00	-14.92
DRCTV845	-100.8	19	12	-13.45	-13.20	-13.45	0.00	-13.45
DRCTV845	-100.8	19	13	-14.00	-13.89	-14.00	0.00	-14.00
DRCTV845	-100.8	19	14	-15.69	-15.58	-15.69	0.00	-15.69
DRCTV845	-100.8	19	15	-14.29	-14.22	-14.29	0.00	-14.29
DRCTV845	-100.8	19	16	-13.71	-13.60	-13.71	0.00	-13.71
DRCTV845	-100.8	19	17	-13.30	-13.22	-13.30	0.00	-13.30
DRCTV845	-100.8	19	18	-13.34	-13.27	-13.34	0.00	-13.34
DRCTV845	-100.8	19	19	-12.48	-12.39	-12.48	0.00	-12.48
DRCTV845	-100.8	19	20	-22.64	-22.58	-22.64	0.00	-22.64
DRCTV845	-100.8	21	1	-13.72	-13.59	-13.72	0.00	-13.72
DRCTV845	-100.8	21	2	-13.74	-13.60	-13.74	0.00	-13.74
DRCTV845	-100.8	21	3	-13.54	-13.36	-13.54	0.00	-13.54
DRCTV845	-100.8	21	4	-14.38	-14.26	-14.38	0.00	-14.38
DRCTV845	-100.8	21	5	-14.23	-14.11	-14.23	0.00	-14.23

DRCTV845	-100.8	21	6	-13.95	-13.74	-13.95	0.00	-13.95
DRCTV845	-100.8	21	7	-15.03	-14.79	-15.03	0.00	-15.03
DRCTV845	-100.8	21	8	-14.65	-14.47	-14.65	0.00	-14.65
DRCTV845	-100.8	21	9	-13.75	-13.59	-13.75	0.00	-13.75
DRCTV845	-100.8	21	10	-15.02	-14.94	-15.02	0.00	-15.02
DRCTV845	-100.8	21	11	-14.91	-14.77	-14.91	0.00	-14.91
DRCTV845	-100.8	21	12	-13.40	-13.16	-13.40	0.00	-13.40
DRCTV845	-100.8	21	13	-13.98	-13.87	-13.98	0.00	-13.98
DRCTV845	-100.8	21	14	-15.68	-15.57	-15.68	0.00	-15.68
DRCTV845	-100.8	21	15	-14.27	-14.20	-14.27	0.00	-14.27
DRCTV845	-100.8	21	16	-13.69	-13.58	-13.69	0.00	-13.69
DRCTV845	-100.8	21	17	-13.34	-13.26	-13.34	0.00	-13.34
DRCTV845	-100.8	21	18	-13.39	-13.33	-13.39	0.00	-13.39
DRCTV845	-100.8	21	19	-12.46	-12.38	-12.46	0.00	-12.46
DRCTV845	-100.8	21	20	-22.63	-22.56	-22.63	0.00	-22.63
DRCTV845	-100.8	23	1	-13.74	-13.61	-13.74	0.00	-13.74
DRCTV845	-100.8	23	2	-13.77	-13.63	-13.77	0.00	-13.77
DRCTV845	-100.8	23	3	-13.57	-13.38	-13.57	0.00	-13.57
DRCTV845	-100.8	23	4	-14.41	-14.29	-14.41	0.00	-14.41
DRCTV845	-100.8	23	5	-14.26	-14.14	-14.26	0.00	-14.26
DRCTV845	-100.8	23	6	-13.98	-13.77	-13.98	0.00	-13.98
DRCTV845	-100.8	23	7	-15.08	-14.83	-15.08	0.00	-15.08
DRCTV845	-100.8	23	8	-14.69	-14.51	-14.69	0.00	-14.69
DRCTV845	-100.8	23	9	-13.77	-13.61	-13.77	0.00	-13.77
DRCTV845	-100.8	23	10	-15.07	-14.99	-15.07	0.00	-15.07
DRCTV845	-100.8	23	11	-14.91	-14.77	-14.91	0.00	-14.91
DRCTV845	-100.8	23	12	-13.43	-13.18	-13.43	0.00	-13.43
DRCTV845	-100.8	23	13	-13.99	-13.88	-13.99	0.00	-13.99
DRCTV845	-100.8	23	14	-15.71	-15.60	-15.71	0.00	-15.71
DRCTV845	-100.8	23	15	-14.29	-14.22	-14.29	0.00	-14.29
DRCTV845	-100.8	23	16	-13.69	-13.58	-13.69	0.00	-13.69
DRCTV845	-100.8	23	17	-13.31	-13.23	-13.31	0.00	-13.31
DRCTV845	-100.8	23	18	-13.33	-13.26	-13.33	0.00	-13.33
DRCTV845	-100.8	23	19	-12.46	-12.37	-12.46	0.00	-12.46
DRCTV845	-100.8	23	20	-22.64	-22.58	-22.64	0.00	-22.64
DRCTV845	-100.8	25	1	-13.70	-13.56	-13.70	0.00	-13.70
DRCTV845	-100.8	25	2	-13.72	-13.58	-13.72	0.00	-13.72
DRCTV845	-100.8	25	3	-13.52	-13.34	-13.52	0.00	-13.52
DRCTV845	-100.8	25	4	-14.37	-14.25	-14.37	0.00	-14.37
DRCTV845	-100.8	25	5	-14.21	-14.10	-14.21	0.00	-14.21
DRCTV845	-100.8	25	6	-13.93	-13.72	-13.93	0.00	-13.93
DRCTV845	-100.8	25	7	-15.03	-14.79	-15.03	0.00	-15.03
DRCTV845	-100.8	25	8	-14.64	-14.46	-14.64	0.00	-14.64
DRCTV845	-100.8	25	9	-13.74	-13.58	-13.74	0.00	-13.74
DRCTV845	-100.8	25	10	-15.03	-14.94	-15.03	0.00	-15.03
DRCTV845	-100.8	25	11	-14.90	-14.76	-14.90	0.00	-14.90
DRCTV845	-100.8	25	12	-13.40	-13.15	-13.40	0.00	-13.40
DRCTV845	-100.8	25	13	-13.97	-13.86	-13.97	0.00	-13.97
DRCTV845	-100.8	25	14	-15.68	-15.57	-15.68	0.00	-15.68
DRCTV845	-100.8	25	15	-14.27	-14.20	-14.27	0.00	-14.27
DRCTV845	-100.8	25	16	-13.68	-13.57	-13.68	0.00	-13.68
DRCTV845	-100.8	25	17	-13.33	-13.25	-13.33	0.00	-13.33
DRCTV845	-100.8	25	18	-13.38	-13.33	-13.38	0.00	-13.38
DRCTV845	-100.8	25	19	-12.45	-12.37	-12.45	0.00	-12.45
DRCTV845	-100.8	25	20	-22.63	-22.56	-22.63	0.00	-22.63
DRCTV845	-100.8	27	1	-13.75	-13.62	-13.75	0.00	-13.75
DRCTV845	-100.8	27	2	-13.78	-13.64	-13.78	0.00	-13.78
DRCTV845	-100.8	27	3	-13.58	-13.40	-13.58	0.00	-13.58
DRCTV845	-100.8	27	4	-14.42	-14.30	-14.42	0.00	-14.42
DRCTV845	-100.8	27	5	-14.27	-14.16	-14.27	0.00	-14.27
DRCTV845	-100.8	27	6	-13.99	-13.78	-13.99	0.00	-13.99
DRCTV845	-100.8	27	7	-15.08	-14.84	-15.08	0.00	-15.08
DRCTV845	-100.8	27	8	-14.69	-14.51	-14.69	0.00	-14.69
DRCTV845	-100.8	27	9	-13.78	-13.61	-13.78	0.00	-13.78
DRCTV845	-100.8	27	10	-15.04	-14.96	-15.04	0.00	-15.04
DRCTV845	-100.8	27	11	-14.91	-14.77	-14.91	0.00	-14.91
DRCTV845	-100.8	27	12	-13.44	-13.19	-13.44	0.00	-13.44
DRCTV845	-100.8	27	13	-13.99	-13.88	-13.99	0.00	-13.99
DRCTV845	-100.8	27	14	-15.70	-15.59	-15.70	0.00	-15.70
DRCTV845	-100.8	27	15	-14.29	-14.22	-14.29	0.00	-14.29
DRCTV845	-100.8	27	16	-13.69	-13.58	-13.69	0.00	-13.69
DRCTV845	-100.8	27	17	-13.30	-13.21	-13.30	0.00	-13.30
DRCTV845	-100.8	27	18	-13.33	-13.27	-13.33	0.00	-13.33
DRCTV845	-100.8	27	19	-12.46	-12.38	-12.46	0.00	-12.46

DRCTV845	-100.8	27	20	-22.65	-22.58	-22.65	0.00	-22.65
DRCTV845	-100.8	29	1	-13.72	-13.59	-13.72	0.00	-13.72
DRCTV845	-100.8	29	2	-13.74	-13.60	-13.74	0.00	-13.74
DRCTV845	-100.8	29	3	-13.54	-13.35	-13.54	0.00	-13.54
DRCTV845	-100.8	29	4	-14.39	-14.26	-14.39	0.00	-14.39
DRCTV845	-100.8	29	5	-14.24	-14.12	-14.24	0.00	-14.24
DRCTV845	-100.8	29	6	-13.95	-13.74	-13.95	0.00	-13.95
DRCTV845	-100.8	29	7	-15.04	-14.80	-15.04	0.00	-15.04
DRCTV845	-100.8	29	8	-14.65	-14.47	-14.65	0.00	-14.65
DRCTV845	-100.8	29	9	-13.75	-13.59	-13.75	0.00	-13.75
DRCTV845	-100.8	29	10	-15.03	-14.95	-15.03	0.00	-15.03
DRCTV845	-100.8	29	11	-14.91	-14.77	-14.91	0.00	-14.91
DRCTV845	-100.8	29	12	-13.40	-13.15	-13.40	0.00	-13.40
DRCTV845	-100.8	29	13	-13.97	-13.86	-13.97	0.00	-13.97
DRCTV845	-100.8	29	14	-15.72	-15.61	-15.72	0.00	-15.72
DRCTV845	-100.8	29	15	-14.28	-14.21	-14.28	0.00	-14.28
DRCTV845	-100.8	29	16	-13.68	-13.58	-13.68	0.00	-13.68
DRCTV845	-100.8	29	17	-13.34	-13.26	-13.34	0.00	-13.34
DRCTV845	-100.8	29	18	-13.45	-13.39	-13.45	0.00	-13.45
DRCTV845	-100.8	29	19	-12.46	-12.38	-12.46	0.00	-12.46
DRCTV845	-100.8	29	20	-22.63	-22.56	-22.63	0.00	-22.63
DRCTV845	-100.8	31	1	-13.76	-13.63	-13.76	0.00	-13.76
DRCTV845	-100.8	31	2	-13.79	-13.65	-13.79	0.00	-13.79
DRCTV845	-100.8	31	3	-13.59	-13.40	-13.59	0.00	-13.59
DRCTV845	-100.8	31	4	-14.43	-14.30	-14.43	0.00	-14.43
DRCTV845	-100.8	31	5	-14.28	-14.17	-14.28	0.00	-14.28
DRCTV845	-100.8	31	6	-14.00	-13.79	-14.00	0.00	-14.00
DRCTV845	-100.8	31	7	-15.08	-14.84	-15.08	0.00	-15.08
DRCTV845	-100.8	31	8	-14.70	-14.51	-14.70	0.00	-14.70
DRCTV845	-100.8	31	9	-13.78	-13.62	-13.78	0.00	-13.78
DRCTV845	-100.8	31	10	-15.05	-14.96	-15.05	0.00	-15.05
DRCTV845	-100.8	31	11	-14.91	-14.77	-14.91	0.00	-14.91
DRCTV845	-100.8	31	12	-13.46	-13.21	-13.46	0.00	-13.46
DRCTV845	-100.8	31	13	-13.99	-13.88	-13.99	0.00	-13.99
DRCTV845	-100.8	31	14	-15.70	-15.60	-15.70	0.00	-15.70
DRCTV845	-100.8	31	15	-14.30	-14.22	-14.30	0.00	-14.30
DRCTV845	-100.8	31	16	-13.70	-13.59	-13.70	0.00	-13.70
DRCTV845	-100.8	31	17	-13.37	-13.28	-13.37	0.00	-13.37
DRCTV845	-100.8	31	18	-13.35	-13.28	-13.35	0.00	-13.35
DRCTV845	-100.8	31	19	-12.47	-12.39	-12.47	0.00	-12.47
DRCTV845	-100.8	31	20	-22.65	-22.58	-22.65	0.00	-22.65

End of program